PT-7710 User's Manual

First Edition, December 2010

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PT-7710 User's Manual

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1

Introduction

Welcome to the PowerTrans PT-7710, a managed redundant Gigabit Ethernet switch designed especially for connecting Ethernet-enabled devices for industrial field applications.

The following topics are covered in this chapter:

- **Overview**
- **Package Checklist**
- **Software Features**

Overview

The PowerTrans PT-7710 is certified for use in power substation automation systems (IEC 61850-3, IEEE 1613), traffic control systems (NEMA TS 2), and railway applications (EN50121-4). It can be used for Gigabit or Fast Ethernet backbones and supports redundant ring topologies. The PT-7710 switches supports dual redundant power supplies (DC power only): VDC “Power Supply 1 (PWR1)” and “Power Supply 2 (PWR2)”, or VAC “Power Supply (PWR1)” to increase communications reliability. The PT-7710 has a modular design that makes network planning easy and allows greater flexibility. You can install up to 2 Gigabit Ethernet ports and 8 Fast Ethernet ports. Optional front or bottom panel wiring makes the PT-7710 suitable for different applications.

Package Checklist

The PowerTrans PT-7710 is shipped with the following items. If any of these items is missing or damaged, please contact your customer service representative for assistance.

- 1 PowerTrans PT-7710
- Hardware installation guide
- CD-ROM with user’s manual and SNMP MIB file
- Warranty statement
- RJ45-to-DB9 console port cable
- Protective caps for unused ports
- 2 rackmount attachments

Software Features

- Turbo Ring, Turbo Chain, and RSTP/STP (IEEE 802.1w/D)
- IPv6 Ready certified by the IPv6 Logo Committee
- IGMP snooping, GMRP to filter multicast traffic from industrial Ethernet protocols
- Port-based VLAN, IEEE 802.1Q VLAN, GVRP for easier network planning
- QoS-IEEE 802.1p/1Q and TOS/DiffServ to increase determinism
- IEEE 1588 PTP (Precision Time Protocol) for precise time synchronization of networks
- 802.3ad, LACP for bandwidth optimization
- IEEE 802.1X , HTTPS, and SSH to enhance network security
- SNMP V1/V2c/V3 for differential network management
- Modbus/TCP industrial Ethernet protocol
- DHCP Option 82 for IP address assignment with different policies
- RMON for efficient, proactive network monitoring
- Supports ABC-01 for system configuration backup
- Access restriction by MAC address
- Port mirroring for online debugging
- Automatic warnings by email, relay output
- LLDP for automatic topology discovery in network management software
- Automatic recovery of connected device’s IP addresses
- Line-swap fast recovery
- Configuration through web browser, Telnet/serial console, Windows utility, and ABC-01

2

Getting Started

This chapter explains the initial installation process for the PT-7710. There are three ways to access PT-7710's configuration settings: the serial console, Telnet console, and web console. If you do not know the PT-7710's IP address, you can open the serial console by connecting the PT-7710 to a PC's COM port with a short serial cable. You can open the Telnet or web console over an Ethernet LAN or over the Internet.

The following topics are covered in this chapter:

- **Serial Console Configuration (115200, None, 8, 1, VT100)**
- **Configuration by Telnet Console**
- **Configuration by Web Browser**
- **Disabling Telnet and Browser Access**

Serial Console Configuration (115200, None, 8, 1, VT100)

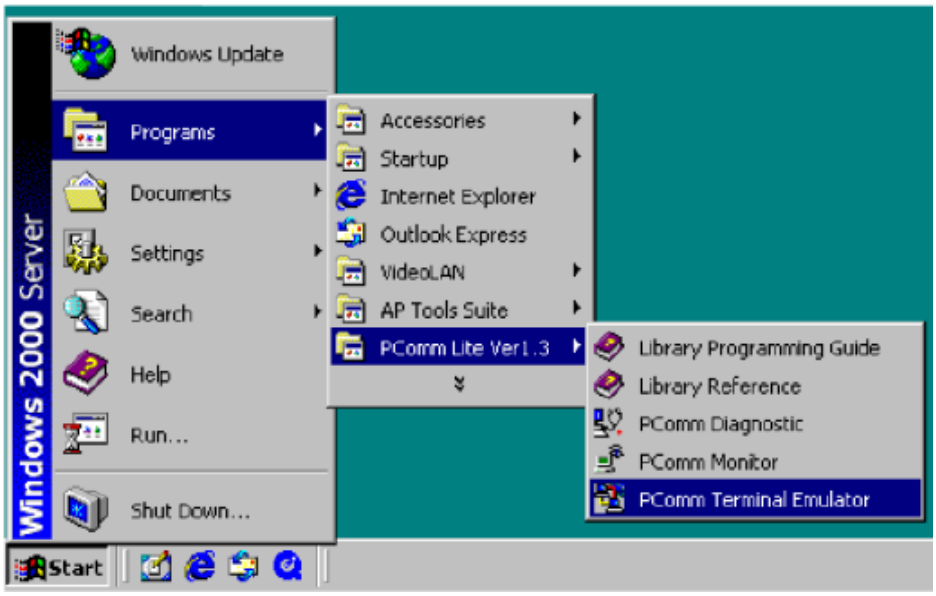
NOTE
- You cannot connect to the serial and Telnet console at the same time.
- You can connect to the web console and another console (serial or Telnet) at the same time. However, it is strongly recommended that you do NOT do so. Following this advice will allow you to maintain better control over the PT-7710's configuration.

NOTE We recommend using PComm Terminal Emulator when opening the serial console. This software can be downloaded free of charge from the Moxa website.

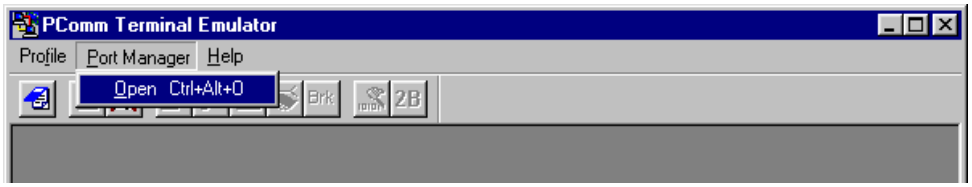
Before running PComm Terminal Emulator, use an RJ45 to DB9-F (or RJ45 to DB25-F) cable to connect the PT-7710's console port to your PC's COM port (generally COM1 or COM2, depending on how your system is set up).

After installing PComm Terminal Emulator, open the PT-7710's serial console as follows:

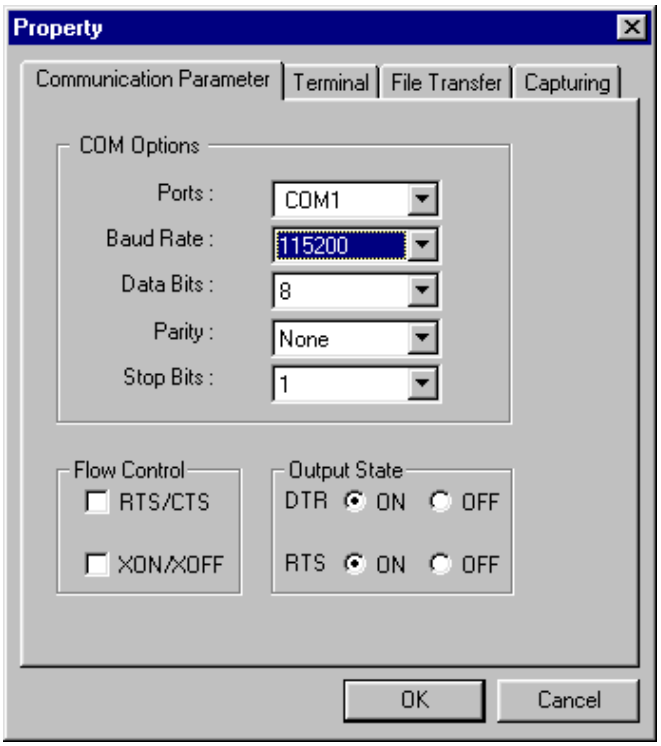
1. From the Windows desktop, navigate to **Start → Programs → PComm Lite 1.3 → Terminal Emulator**.



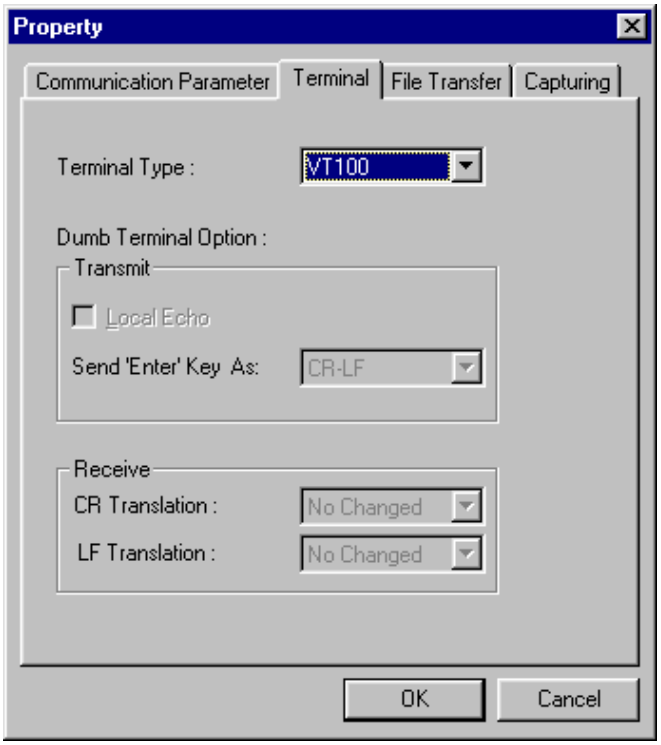
2. Select **Open** under the **Port Manager** menu to open a new connection.



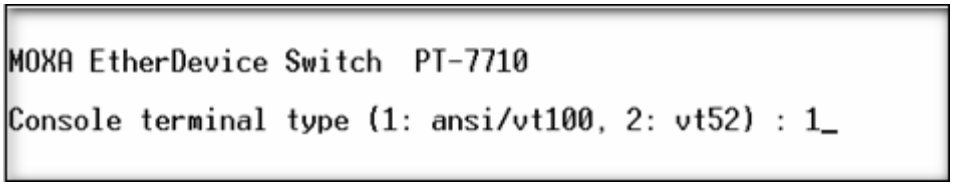
3. The **Property** window should open. On the **Communication Parameter** tab for **Ports**, select the COM port that is being used for the console connection. Set the other fields as follows: **115200** for **Baud Rate**, **8** for **Data Bits**, **None** for **Parity**, and **1** for **Stop Bits**.



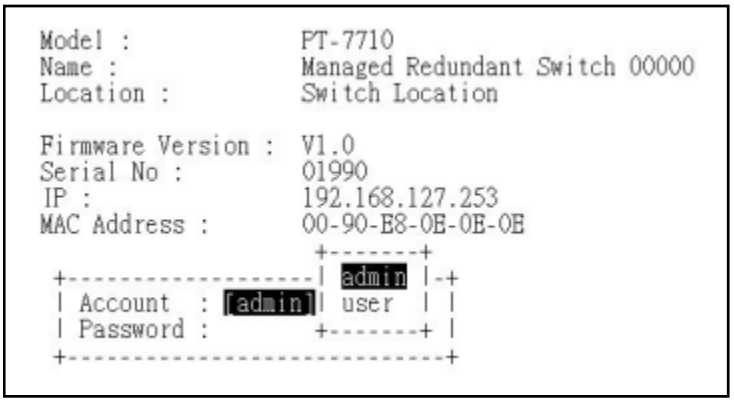
4. On the **Terminal** tab, select **VT100** for **Terminal Type**. Click **OK**.



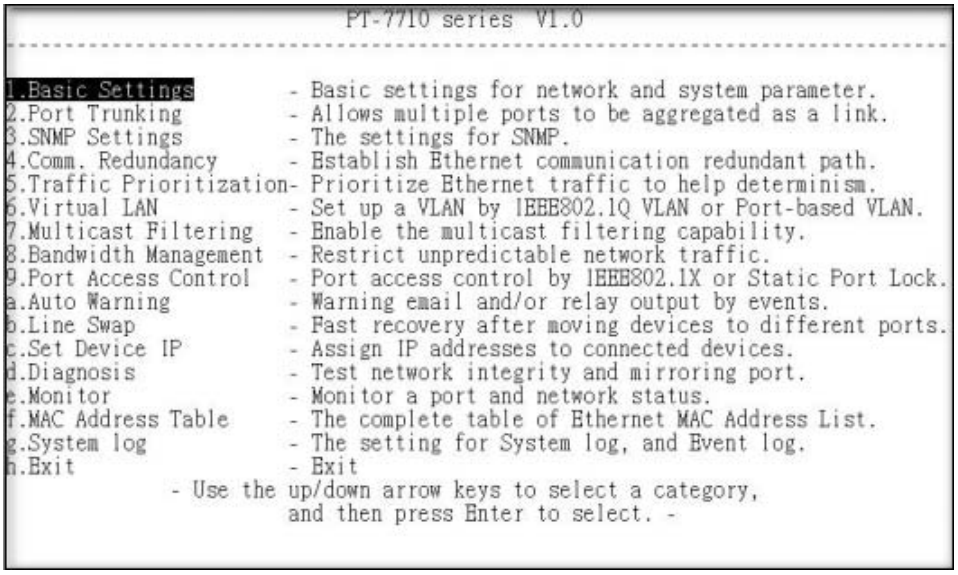
5. In the terminal window, the PT-7710 will prompt you to select a terminal type. Enter **1** to select **ansi/vt100** and press **Enter**.



6. The serial console will prompt you to log in. Press **Enter** and select **admin** or **user**. Use the down arrow key on your keyboard to select the **Password** field and enter a password if desired. This password will be required to access any of the consoles (web, serial, Telnet). If you do not wish to create a password, leave the **Password** field blank and press **Enter**.



7. The **Main Menu** of the PT-7710's serial console should appear. (In PComm Terminal Emulator, you can adjust the font by selecting **Font...** in the **Edit** menu.)


PT-7710 series V1.0
1.Basic Settings - Basic settings for network and system parameter.
2.Port Trunking - Allows multiple ports to be aggregated as a link.
3.SNMP Settings - The settings for SNMP.
4.Comm. Redundancy - Establish Ethernet communication redundant path.
5.Traffic Prioritization- Prioritize Ethernet traffic to help determinism.
6.Virtual LAN - Set up a VLAN by IEEE802.1Q VLAN or Port-based VLAN.
7.Multicast Filtering - Enable the multicast filtering capability.
8.Bandwidth Management - Restrict unpredictable network traffic.
9.Port Access Control - Port access control by IEEE802.1X or Static Port Lock.
a.Auto Warning - Warning email and/or relay output by events.
b.Line Swap - Fast recovery after moving devices to different ports.
c.Set Device IP - Assign IP addresses to connected devices.
d.Diagnosis - Test network integrity and mirroring port.
e.Monitor - Monitor a port and network status.
f.MAC Address Table - The complete table of Ethernet MAC Address List.
g.System log - The setting for System log, and Event log.
h.Exit - Exit
- Use the up/down arrow keys to select a category,
and then press Enter to select. -

8. Use the following keys on your keyboard to navigate the PT-7710's serial console:

Key	Function
Up, down, right, left arrow keys Tab	Move the onscreen cursor
Enter	Display and select options
Space	Toggle options
Esc	Previous menu

Configuration by Telnet Console

You may open the PT-7710's Telnet or web console over a network. This requires that the PC host and PT-7710 are on the same logical subnet. You may need to adjust your PC host's IP address and subnet mask. By default, the PT-7710's IP address is 192.168.127.253 and PT-7710's subnet mask is 255.255.255.0 (for a Class C network). This means that your PC's IP address must be set to 192.168.xxx.xxx for a subnet mask of 255.255.0.0, or to 192.168.127.xxx with a subnet mask of 255.255.255.0.

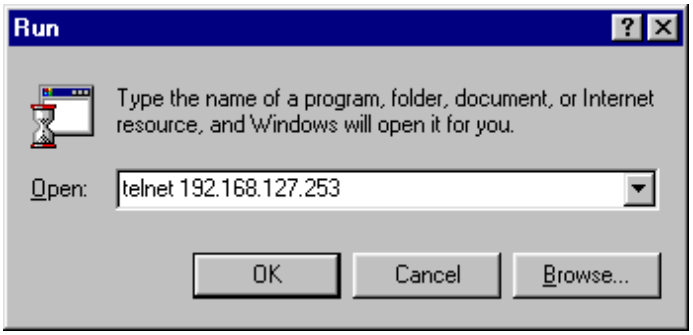
NOTE To connect to the PT-7710's Telnet or web console, your PC host and the PT-7710 must be on the same logical subnet.

NOTE When connecting to the PT-7710's Telnet or web console, first connect one of PT-7710's Ethernet ports to your Ethernet LAN or directly to your PC's Ethernet port. You may use either a straight-through or cross-over Ethernet cable.

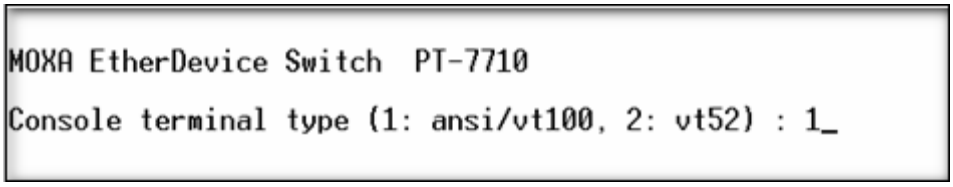
NOTE The PT-7710's default IP address is 192.168.127.253.

After making sure that the PT-7710 is connected to the same LAN and logical subnet as your PC, open the PT-7710's Telnet console as follows:

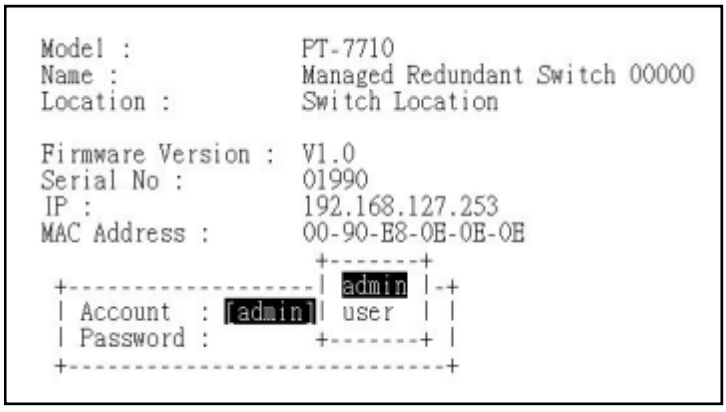
1. Click **Start → Run** from the Windows Start menu. Telnet to the PT-7710's IP address from the Windows **Run** window. You may also issue the Telnet command from a DOS prompt.



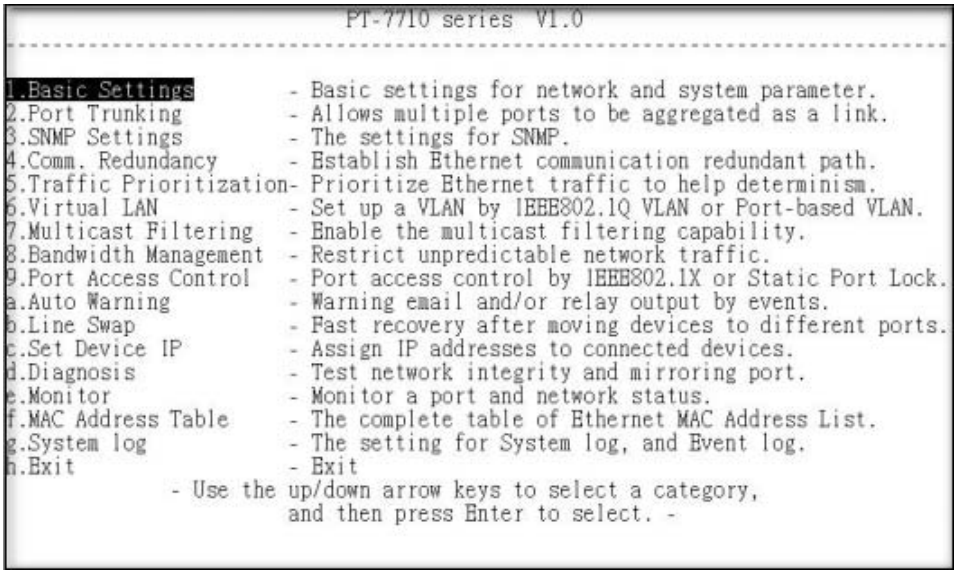
2. In the terminal window, the Telnet console will prompt you to select a terminal type. Type **1** to choose **ansi/vt100**, and then press **Enter**.



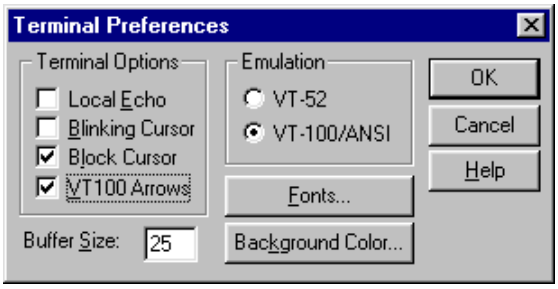
3. The Telnet console will prompt you to log in. Press **Enter** and select **admin** or **user**. Use the down arrow key on your keyboard to select the **Password** field and enter a password if desired. This password will be required to access any of the consoles (web, serial, Telnet). If you do not wish to create a password, leave the **Password** field blank and press **Enter**.



4. The **Main Menu** of the PT-7710's Telnet console should appear.


PT-7710 series V1.0
1.Basic Settings - Basic settings for network and system parameter.
2.Port Trunking - Allows multiple ports to be aggregated as a link.
3.SNMP Settings - The settings for SNMP.
4.Comm. Redundancy - Bstablish Ethernet communication redundant path.
5.Traffic Prioritization- Prioritize Ethernet traffic to help determinism.
6.Virtual LAN - Set up a VLAN by IEEE802.1Q VLAN or Port-based VLAN.
7.Multicast Filtering - Enable the multicast filtering capability.
8.Bandwidth Management - Restrict unpredictable network traffic.
9.Port Access Control - Port access control by IEEE802.1X or Static Port Lock.
a.Auto Warning - Warning email and/or relay output by events.
b.Line Swap - Fast recovery after moving devices to different ports.
c.Set Device IP - Assign IP addresses to connected devices.
d.Diagnosis - Test network integrity and mirroring port.
e.Monitor - Monitor a port and network status.
f.MAC Address Table - The complete table of Ethernet MAC Address List.
g.System log - The setting for System log, and Event log.
h.Exit - Exit
- Use the up/down arrow keys to select a category,
and then press Enter to select. -

5. In the terminal window, select **Preferences…** from the **Terminal** menu on the menu bar.
6. The **Terminal Preferences** window should appear. Make sure that **VT100 Arrows** is checked.



7. Use the following keys on your keyboard to navigate the PT-7710's Telnet console:

Key	Function
Up, down, right, left arrow keys Tab	Move the onscreen cursor
Enter	Display and select options
Space	Toggle options
Esc	Previous menu

NOTE The Telnet console looks and operates in precisely the same manner as the serial console.

Configuration by Web Browser

The PT-7710's web console is a convenient way to modify the configuration and access the built-in monitoring and network administration functions. You can open the PT-7710's web console using a standard web browser such as Internet Explorer or Netscape.

NOTE To connect to the PT-7710's Telnet or web console, your PC host and the PT-7710 must be on the same logical subnet.

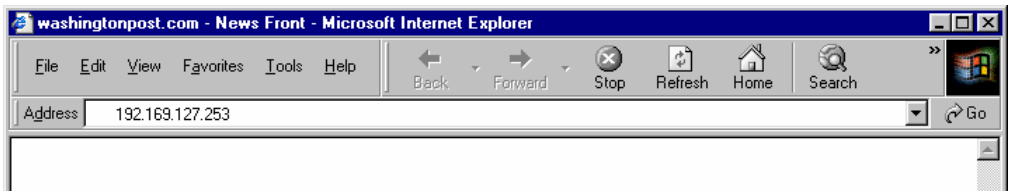
NOTE If the PT-7710 is configured for other VLAN settings, you must make sure your PC host is on the management VLAN.

NOTE When connecting to the PT-7710's Telnet or web console, first connect one of the PT-7710's Ethernet ports to your Ethernet LAN or directly to your PC's Ethernet port. You may use either a straight-through or cross-over Ethernet cable.

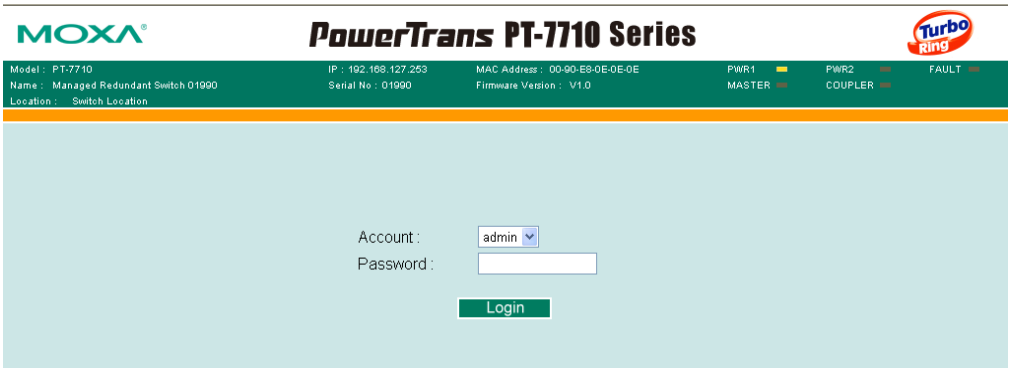
NOTE The PT-7710's default IP address is 192.168.127.253.

After making sure that the PT-7710 is connected to the same LAN and logical subnet as your PC, open the PT-7710's web console as follows:

1. Point your web browser to the PT-7710's IP address by entering it in the **Address** or **URL** field.

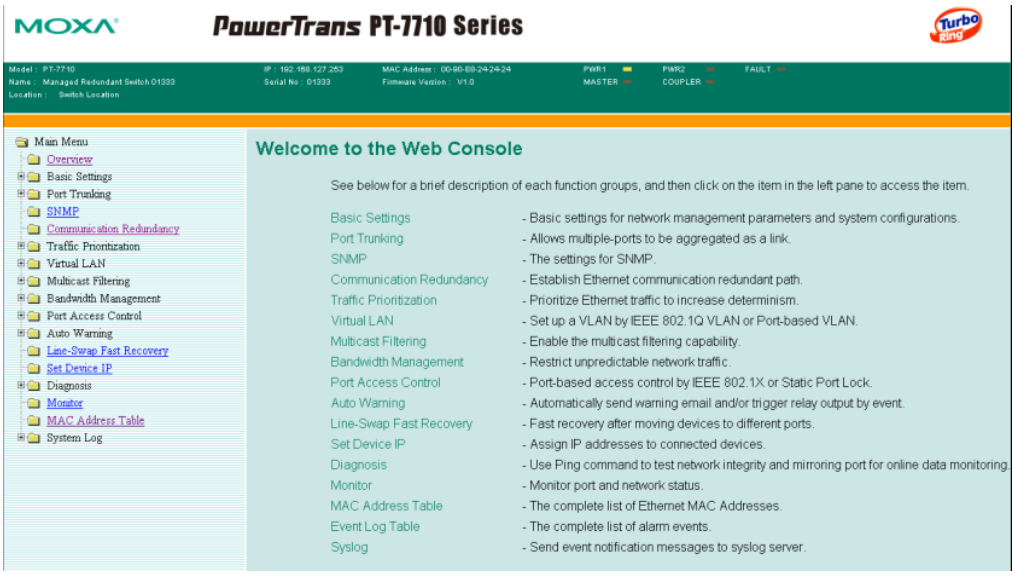

washingtonpost.com - News Front - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Forward Stop Refresh Home Search
Address 192.169.127.253
Go

2. The PT-7710's web console will open, and you will be prompted to log in. Select the login account (admin or user) and enter the **Password**. This password will be required to access any of the consoles (web, serial, Telnet). If you do not wish to create a password, leave the **Password** field blank and press **Enter**.



NOTE By default, no password is assigned to the PT-7710's web, serial, and Telnet consoles.

3. After logging in, you may need to wait a few moments for the web console to appear. Use the folders in the left navigation panel to navigate between different pages of configuration options.


MOXA
PowerTrans PT-7710 Series
Turbo Ring
Main Menu
Overview
Basic Settings
Port Trunking
SNMP
Communication Redundancy
Traffic Prioritization
Virtual LAN
Multicast Filtering
Bandwidth Management
Port Access Control
Auto Warning
Line-Swap Fast Recovery
Set Device IP
Diagnosis
Monitor
MAC Address Table
System Log
Welcome to the Web Console
See below for a brief description of each function groups, and then click on the item in the left pane to access the item.
Basic Settings - Basic settings for network management parameters and system configurations.
Port Trunking - Allows multiple-ports to be aggregated as a link.
SNMP - The settings for SNMP.
Communication Redundancy - Establish Ethernet communication redundant path.
Traffic Prioritization - Prioritize Ethernet traffic to increase determinism.
Virtual LAN - Set up a VLAN by IEEE 802.1Q VLAN or Port-based VLAN.
Multicast Filtering - Enable the multicast filtering capability.
Bandwidth Management - Restrict unpredictable network traffic.
Port Access Control - Port-based access control by IEEE 802.1X or Static Port Lock.
Auto Warning - Automatically send warning email and/or trigger relay output by event.
Line-Swap Fast Recovery - Fast recovery after moving devices to different ports.
Set Device IP - Assign IP addresses to connected devices.
Diagnosis - Use Ping command to test network integrity and mirroring port for online data monitoring.
Monitor - Monitor port and network status.
MAC Address Table - The complete list of Ethernet MAC Addresses.
Event Log Table - The complete list of alarm events.
Syslog - Send event notification messages to syslog server.

Disabling Telnet and Browser Access

If you are connecting the PT-7710 to a public network but do not intend to manage it over the network, we suggest disabling both the Telnet and web consoles. This is done through the serial console, by navigating to **System Identification** under **Basic Settings**. Disable or enable the **Telnet Console** and **Web Configuration** as shown below:

MOXA EtherDevice Switch PT-7710
Basic Settings
[System] [Password] [Accessible IP] [Port] [Network] [Time] [Backup Media]
[Restart] [Factory default] [Upgrade] [Activate] [Main menu]
System Identification
ESC: Previous menu Enter: Select Space bar: Toggle
Switch Name [Managed Redundant Switch 00000]
Switch Location [Switch Location]
Switch Description [ ]
Maintainer Contact Info [ ]
Serial NO. 01990
Firmware Version V1.0
MAC Address 00-90-E8-0E-0E-0E
Telnet Console [Enable]
Web Configuration [http or https]

3

Featured Functions

This chapter explains how to access the PT-7710's various configuration, monitoring, and administration functions. These functions can be accessed by serial, Telnet, or web console. The serial console can be used if you do not know the PT-7710's IP address and requires that you connect the PT-7710 to a PC COM port. The Telnet and web consoles can be opened over an Ethernet LAN or the Internet.

The web console is the most user-friendly way to configure the PT-7710. In this chapter, we use the web console interface to introduce the functions. There are only a few differences between the web console, serial console, and Telnet console.

The following topics are covered in this chapter:

- **Configuring Basic Settings**
- **Using Port Trunks**
- **Configuring SNMP**
- **Using Network Redundancy**
- **Using Traffic Prioritization**
- **Using Virtual LAN**
- **Using Multicast Filtering**
- **Using Bandwidth Management**
- **Using Port Access Control**
- **Using Auto Warning**
- **Using Line-Swap-Fast-Recovery**
- **Using Set Device IP**
- **Using Diagnosis**
- **Using the Monitor**
- **Using the MAC Address Table**
- **Using the Event Log**
- **Using Syslog**

Configuring Basic Settings

Basic Settings includes the most common settings required by administrators to maintain and control the PT-7710.

System Identification

System Identification items are displayed at the top of the web console and will be included in alarm emails. You can set the System Identification items to make it easier to identify different switches that are connected to your network.

Switch Name

Setting	Description	Factory Default
Max. 30 characters	This option is useful for differentiating between the roles or applications of different units. Example: Factory Switch 1.	Managed Redundant Switch [Serial no. of this switch]

Switch Location

Setting	Description	Factory Default
Max. 80 characters	This option is useful for differentiating between the locations of different units. Example: production line 1.	Switch Location

Switch Description

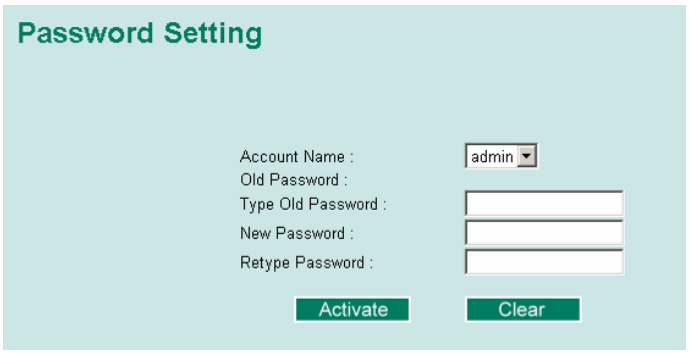
Setting	Description	Factory Default
Max. 30 characters	This option is useful for recording a more detailed description of the unit.	None

Maintainer Contact Info

Setting	Description	Factory Default
Max. 30 characters	This option is useful for providing information about who is responsible for maintaining this unit and how to contact this person.	None

Password

The PT-7710 provides two levels of configuration access. The **admin** account has read/write access of all configuration parameters, and the **user** account has read access only. The **user** account can only view the configuration, but will not be able to make modifications.



ATTENTION

By default, no password is assigned to the PT-7710's web, Telnet, and serial consoles. If a password is assigned, you will be required to enter the password when you open the serial console, Telnet console, or Web console.

Account

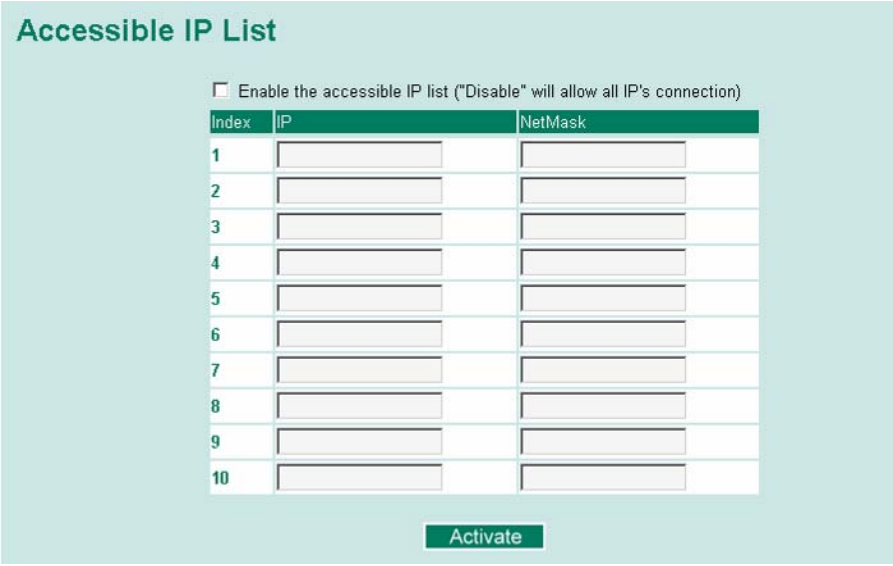
Setting	Description	Factory Default
Admin	This account can modify the PT-7710's configuration.	admin
User	This account can only view the PT-7710's configurations.	

Password

Setting	Description	Factory Default
Old password (max. 16 characters)	Enter the current password	None
New password (Max. 16 characters)	Enter the desired new password. Leave it blank if you want to remove the password.	None
Retype password (Max. 16 characters)	Enter the desired new password again. Leave it blank if you want to remove the password.	None

Accessible IPs

The PT-7710 uses an IP address-based filtering method to control access.



You may add or remove IP addresses to limit access to the PT-7710. When the accessible IP list is enabled, only addresses on the list will be allowed access to the PT-7710. Each IP address and netmask entry can be tailored for different situations:

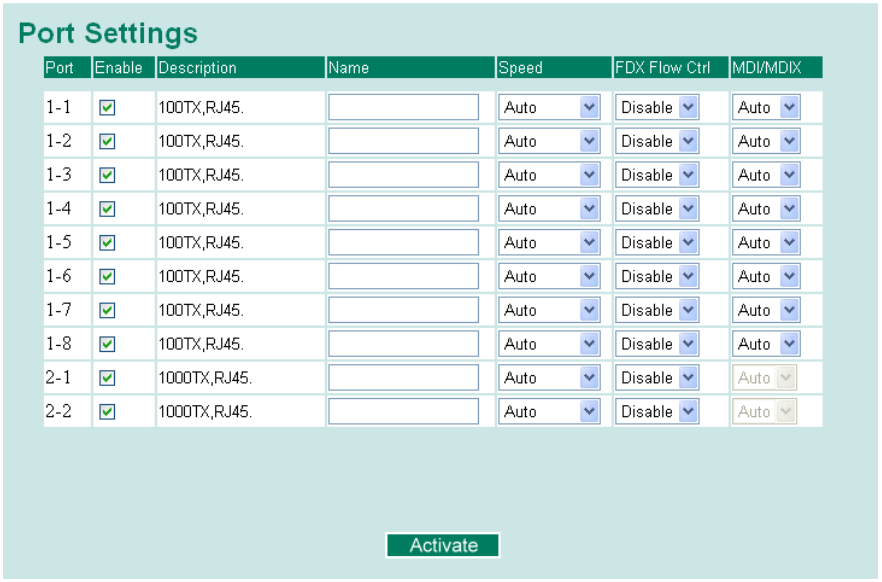
- **Grant access to one host with a specific IP address**
  For example, enter IP address 192.168.1.1 with netmask 255.255.255.255 to allow access to 192.168.1.1 only.
- **Grant access to any host on a specific subnetwork**
  For example, enter IP address 192.168.1.0 with netmask 255.255.255.0 to allow access to all IPs on the subnet defined by this IP address/subnet mask combination.
- **Grant access to all hosts**
  Make sure the accessible IP list is not enabled. Remove the checkmark from **Enable the accessible IP list**.

The following table shows additional configuration examples:

Hosts That Need Access	Input Format
Any host	Disable
192.168.1.120	192.168.1.120 / 255.255.255.255
192.168.1.1 to 192.168.1.254	192.168.1.0 / 255.255.255.0
192.168.0.1 to 192.168.255.254	192.168.0.0 / 255.255.0.0
192.168.1.1 to 192.168.1.126	192.168.1.0 / 255.255.255.128
192.168.1.129 to 192.168.1.254	192.168.1.128 / 255.255.255.128

Port

Port settings are included to give the user control over port access, port transmission speed, flow control, and port type (MDI or MDIX).



Enable

Setting	Description	Factory Default
Checked	Allows data transmission through the port.	Enabled
Unchecked	Immediately shuts off port access.	

ATTENTION

If a connected device or sub-network is wreaking havoc on the rest of the network, the **Disable** option under **Advanced Settings / Port** gives the administrator a quick way to shut off access through this port immediately.

Description

Setting	Description	Factory Default
Media type	Displays the media type for each module's port	N/A

Name

Setting	Description	Factory Default
Max. 63 characters	Specifies an alias for the port to help administrators differentiate between different ports. Example: PLC 1	None

Speed

Setting	Description	Factory Default
Auto	Allows the port to use the IEEE 802.3u protocol to negotiate with connected devices. The port and connected devices will determine the best speed for that connection.	Auto
100M-Full	Choose one of these fixed speed options if the connected Ethernet device has trouble auto-negotiating.	
100M-Half		
10M-Full exclude Gigabit Ethernet module		
10M-Half exclude Gigabit Ethernet module		

FDX Flow Ctrl

This setting enables or disables flow control for the port when the port's Speed is set to Auto. The final result will be determined by the Auto process between the PT-7710 and connected devices.

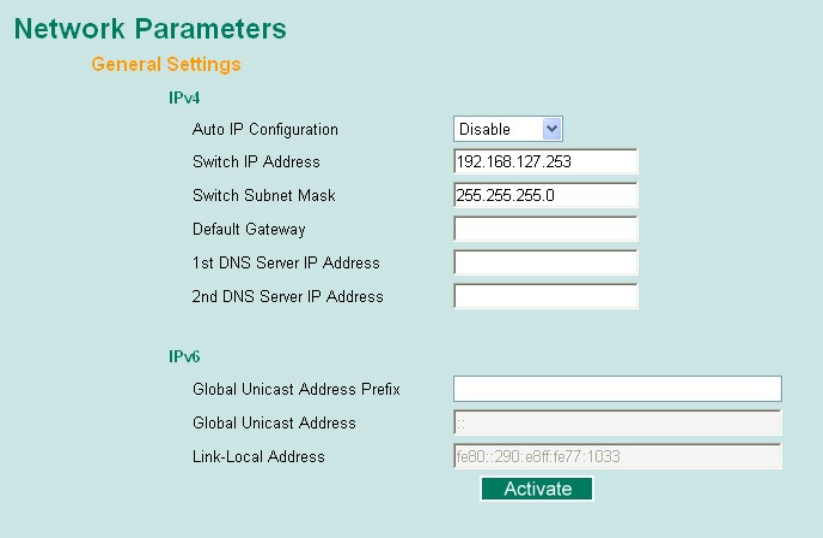
Setting	Description	Factory Default
Enable	Enables flow control for this port when the port's Speed is set to Auto.	Disable
Disable	Disables flow control for this port when the port's Speed is set to Auto.	

MDI/MDIX

Setting	Description	Factory Default
Auto	Allows the port to auto-detect the port type of the connected Ethernet device and change the port type accordingly.	Auto
MDI	Choose MDI or MDIX if the connected Ethernet device has trouble auto-negotiating for port type.	
MDIX		

Network Settings

The **Network Parameters** page allows users to configure both IPv4 and IPv6 parameters for management access over the network. This Moxa Ethernet switch supports both IPv4 and IPv6, and can be managed using either of these address types. An explanation of each configuration item follows.



IPv4

Auto IP Configuration

Setting	Description	Factory Default
Disable	Select to set the PT-7710's IP address manually.	Disable
By DHCP	The PT-7710's IP address will be assigned automatically by the network's DHCP server.	
By BootP	The PT-7710's IP address will be assigned automatically by the network's BootP server.	

Switch IP Address

Setting	Description	Factory Default
IP address for the PT-7710	Assigns the PT-7710's IP address on a TCP/IP network.	192.168.127.253

Switch Subnet Mask

Setting	Description	Factory Default
Subnet mask for the PT-7710	Identifies the type of network to which the PT-7710 is connected (e.g., 255.255.0.0 for a Class B network, or 255.255.255.0 for a Class C network).	255.255.255.0

Default Gateway

Setting	Description	Factory Default
IP address for gateway	Specifies the IP address of the router that connects the LAN to an outside network.	None

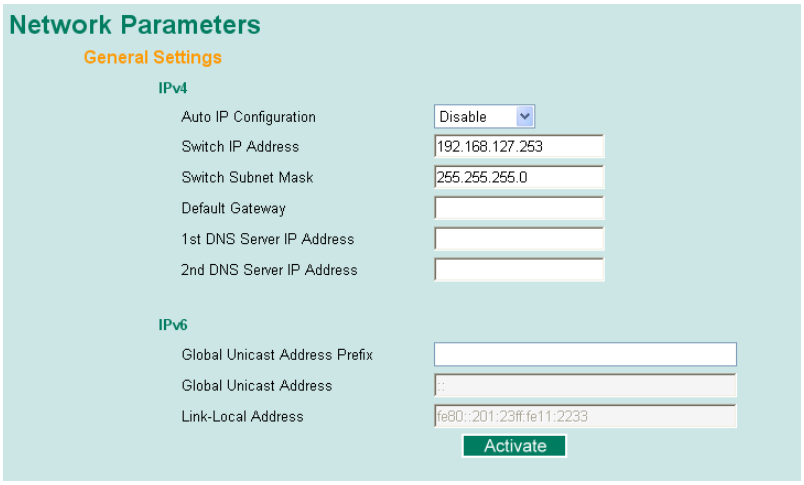
DNS IP Address

Setting	Description	Factory Default
IP address for DNS server	Specifies the IP address of the DNS server used by your network. After specifying the DNS server's IP address, you can use the PT-7710's URL (e.g., www.PT.company.com) to open the web console instead of entering the IP address.	None

IP address for 2nd DNS server	Specifies the IP address of the secondary DNS server used by your network. The PT-7710 will use the secondary DNS server if the first DNS server fails to connect.	None

IPv6

IPv6 settings include two distinct address types: Link-Local Unicast address and Global Unicast address. A Link-Local address makes the switch accessible over IPv6 for all devices attached to the same local subnet. To connect to a larger network with multiple segments, the switch must be configured with a Global Unicast address.



Global Unicast Address Prefix (Prefix Length: 64 bits)

Setting	Description	Factory Default
Global Unicast Address Prefix	The prefix value must be formatted according to RFC 2373 "IPv6 Addressing Architecture," using 8 colon-separated 16-bit hexadecimal values. One double colon may be used in the address to indicate the appropriate number of zeros required to fill the undefined fields.	None

Global Unicast Address

Setting	Description	Factory Default
None	Displays the IPv6 Global Unicast address. The network portion of Global Unicast address can be configured by specifying the Global Unicast Prefix and using a EUI-64 interface ID in the low order 64 bits. The host portion of Global Unicast address is automatically generated using the modified EUI-64 form of the interface identifier (Switch's MAC address).	

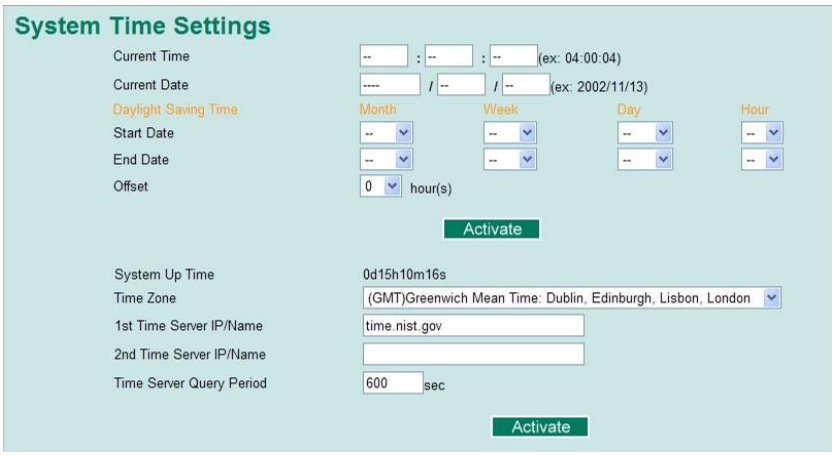
Link-Local Address

Setting	Description	Factory Default
None	The network portion of Link-Local address is FE80 and the host portion of Link-Local address is automatically generated using the modified EUI-64 form of the interface identifier (Switch's MAC address).	FE80: (EUI-64 form of the MAC address)

Neighbor Cache

Setting	Description	Factory Default
None	The information in the neighbor cache that includes the neighboring node IPv6 address, the corresponding Link-Layer address, and current state of the entry.	None

Time



The PT-7710 has a time calibration function based on information from an NTP server or user specified time and date. Functions such as automatic warning emails can therefore include time and date stamp.

NOTE The PT-7710 does not have a real time clock. The user must update the Current Time and Current Date to set the initial time of the PT-7710 after each reboot, especially when there is no NTP server on the LAN or Internet connection.

Current Time

Setting	Description	Factory Default
User-specified time	Allows configuration of the local time in local 24-hour format.	00h:00m:00s

Current Date

Setting	Description	Factory Default
User-specified date	Allows configuration of the local date in yyyy-mm-dd format.	1970/01/01

Daylight Saving Time

The Daylight Saving Time settings are used to automatically offset the PT-7710's time forward according to national standards.

Start Date

Setting	Description	Factory Default
User-specified date	Specifies the date on which Daylight Saving Time begins.	None

End Date

Setting	Description	Factory Default
User-specified date	Specifies the date on which Daylight Saving Time ends.	None

Offset

Setting	Description	Factory Default
User-specified hour	Specifies the number of hours that the time should be offset forward during Daylight Savings Time.	None

System Up Time

Indicates how long the PT-7710 remained up since the last cold start. The up time is indicated in seconds.

Time Zone

Setting	Description	Factory Default
Time zone	Specifies the time zone, which is used to determine the local time offset from GMT (Greenwich Mean Time).	GMT (Greenwich Mean Time)

NOTE Changing the time zone will automatically correct the current time. Make sure to set the time zone before setting the time.

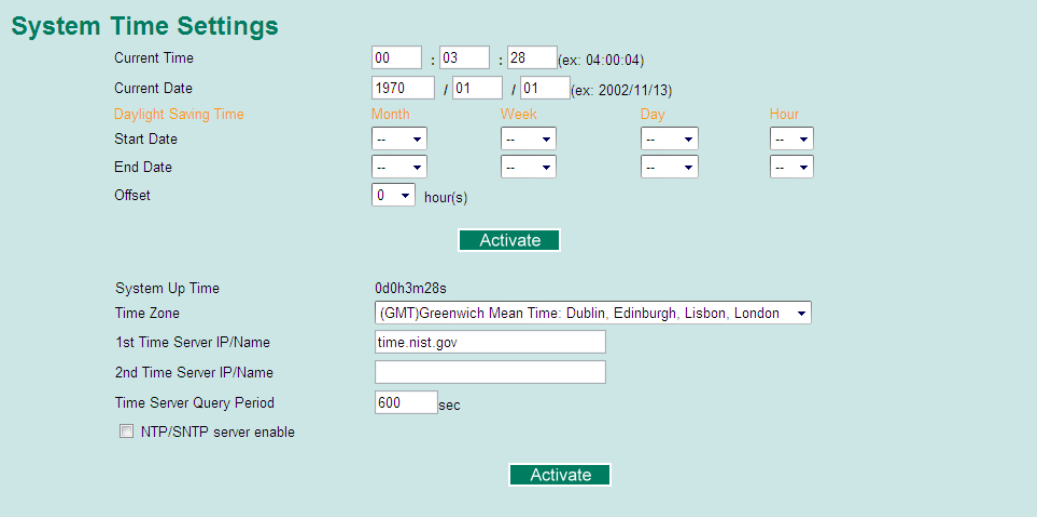
Time Server IP/Name

Setting	Description	Factory Default
IP address or name of time server	The IP or domain address (e.g., 192.168.1.1, time.stdtime.gov.tw, or time.nist.gov).	None
IP address or name of secondary time server	The PT-7710 will try to locate the secondary NTP server if the first NTP server fails to connect.	

Time Server Query Period

Setting	Description	Factory Default
Query period	This parameter determines how frequently the time is updated from the NTP server.	600 seconds

System Time Settings



The PT-7710 has a time calibration function based on information from an NTP server or user specified time and date. Functions such as automatic warning emails can therefore include time and date stamp.

NOTE The PT-7710 does not have a real time clock. The user must update the Current Time and Current Date to set the initial time for PT-7710 after each reboot, especially when there is no NTP server on the LAN or Internet connection.

Current Time

Setting	Description	Factory Default
User-specified time	Allows configuration of the local time in local 24-hour format.	None

Current Date

Setting	Description	Factory Default
User-specified date	Allows configuration of the local date in yyyy-mm-dd format.	None

Daylight Saving Time

The Daylight Saving Time settings are used to automatically offset the PT-7710's time forward according to national standards.

Start Date

Setting	Description	Factory Default
User-specified date	Specifies the date on which Daylight Saving Time begins.	None

End Date

Setting	Description	Factory Default
User-specified date	Specifies the date on which Daylight Saving Time ends.	None

Offset

Setting	Description	Factory Default
User-specified hour	Specifies the number of hours that the time should be offset forward during Daylight Saving Time.	None

System Up Time

Indicates how long the PT-7710 remained up since the last cold start. The up time is indicated in seconds.

Time Zone

Setting	Description	Factory Default
Time zone	Specifies the time zone, which is used to determine the local time offset from GMT (Greenwich Mean Time).	GMT (Greenwich Mean Time)

NOTE Changing the time zone will automatically correct the current time. Make sure to set the time zone before setting the time.

Time Server IP/Name

Setting	Description	Factory Default
IP address or name of time server	The IP or domain address (e.g., 192.168.1.1, time.stdtime.gov.tw, or time.nist.gov).	None
IP address or name of secondary time server	The PT-7710 will try to locate the secondary NTP server if the first NTP server fails to connect.	

Time Server Query Period

Setting	Description	Factory Default
Query period	This parameter determines how frequently the time is updated from the NTP server.	600 seconds

Enable NTP/SNTP Server

Setting	Description	Factory Default
Enable/Disable	Enables or disables NTP or SNTP server.	Disable

Configuring IEEE 1588/PTP

Time synchronization may be accomplished using the **IEEE Standard for a Precision Clock Synchronization Protocol for Networked Measurement and Control Systems (IEEE 1588-2008)** to synchronize real-time clocks incorporated within each component of the electrical power system in power automation applications.

IEEE 1588, published in November 2002, is a new technology that expands the performance capabilities of Ethernet networks for measurement and control over a communication network. In recent years, an increasing number of electrical power systems have been utilizing a more distributed architecture and less stringent timing specifications. IEEE 1588 establishes a master-slave relationship between the clocks, and enforces the specific timing requirements. All devices ultimately derive their time from a clock known as the grandmaster clock. In its basic form, the protocol is intended to be administration free.

How does an Ethernet switch affect 1588 synchronization?

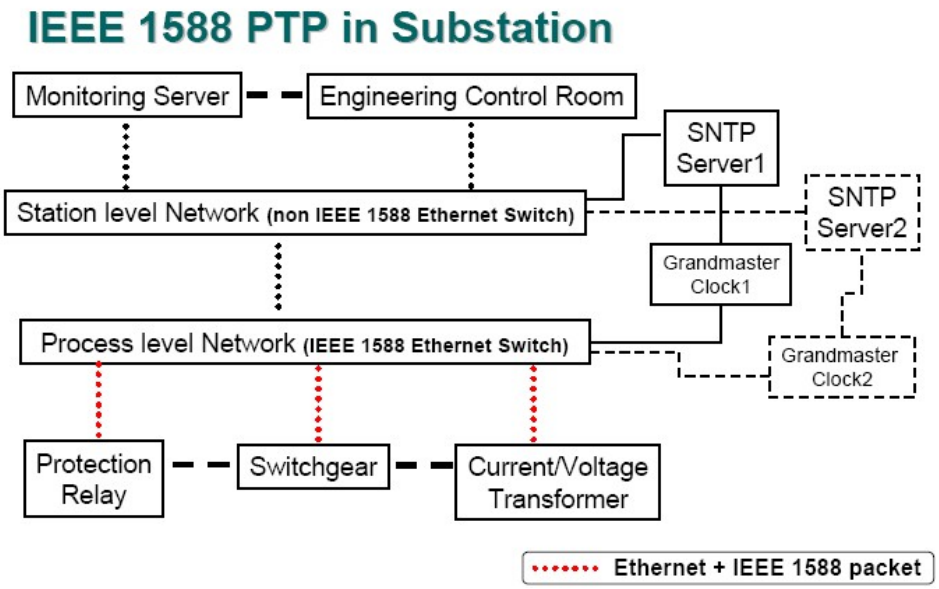
An Ethernet switch potentially introduces multi-microsecond fluctuations in the latency between the 1588 grandmaster clock and a 1588 slave clock. Uncorrected these fluctuations will cause synchronization errors. The magnitude of these fluctuations depends on the design of the Ethernet switch and the details of the communication traffic. Experiments with prototype implementations of IEEE 1588 indicate that with suitable care the effect of these fluctuations can be successfully managed. For example, use of appropriate statistics in the 1588 devices to recognize significant fluctuations and use suitable averaging techniques in the algorithms controlling the correction of the local 1588 clock will achieve the highest time accuracy.

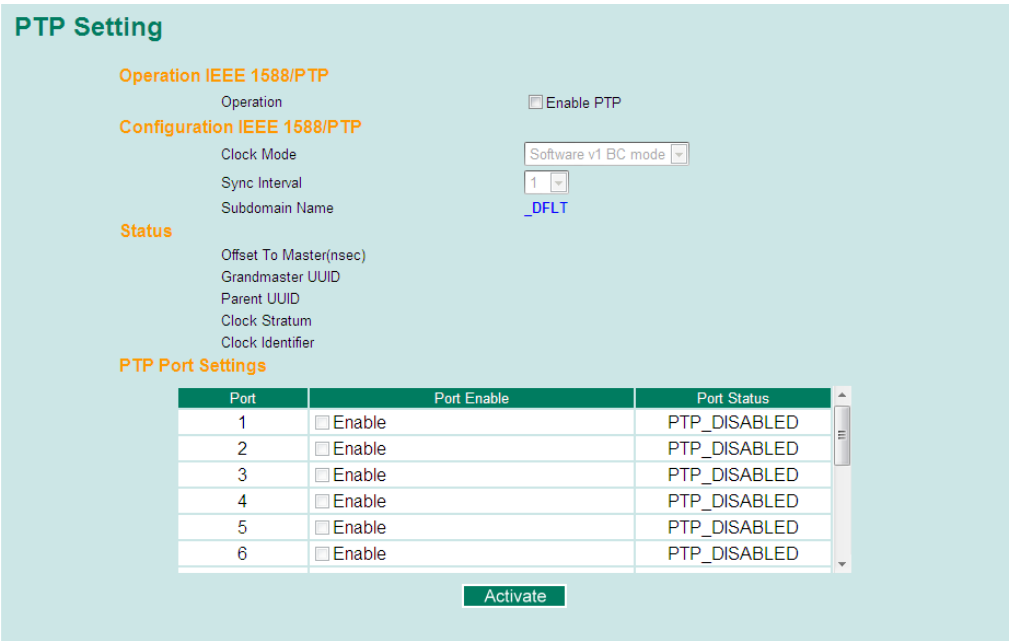
Can Ethernet switches be designed to avoid the effects of these fluctuations?

A switch may be designed to support IEEE 1588 while avoiding the effects of queuing. In this case two modifications to the usual design of an Ethernet switch are necessary:

1. The **Boundary / Transparent Clock** functionality defined by IEEE 1588 must be implemented in the switch, and
2. The switch must be configured such that it does not pass IEEE 1588 message traffic using the normal communication mechanisms of the switch.

Such an Ethernet switch will synchronize clocks directly connected to one of its ports to the highest possible accuracy.





PTP Setting

Operation IEEE 1588/PTP

Setting	Description	Factory Default
Operation	Disable or enable IEEE 1588(PTP) operation	Disable

Configuration IEEE 1588/PTP

Setting	Description	Factory Default
Clock Mode	Support software-based IEEE 1588(PTP) mode	Disable
Sync Interval	Period for sending synchronization message (in seconds)	Disable
Subdomain Name	Support _DFLT(Default) domain only	_DFLT

Status

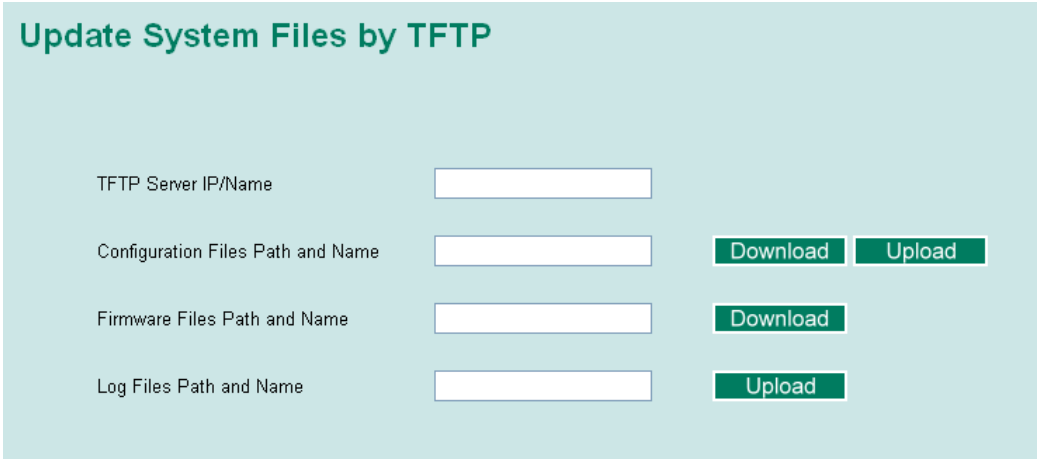
Setting	Description	Factory Default
Offset To Master(nsec)	The deviation between local time and the reference clock in nanoseconds.	
Grandmaster UUID	When the clock has a port in the PTP_SLAVE state, this member's value shall be the value of the grand master Clock UUID field of the last Sync message received from the parent of the slave port.	
Parent UUID	When the clock has a port in the PTP_SLAVE state, this member's value shall be the value of the source UUID field of the last Sync message received from the parent of the slave port.	
Clock Stratum	The stratum number describes one measure of the quality of a clock. Each clock shall be characterized by a stratum number to be used by the best master clock algorithm as one parameter of clock quality.	4
Clock Identifier	Properties of the clock.	DFLT

PTP Port Settings

Setting	Description	Factory Default
Port Enable	Enable or disable PTP port operation.	None
Port Status	Display PTP port real status.	PTP_DISABLED

System File Update—By Remote TFTP

The PT-7710 supports saving your configuration or log file to a remote TFTP server or local host. Other PT-7710 switches can also load the configuration at a later time. The PT-7710 also supports loading firmware or configuration files from the TFTP server or a local host.



TFTP Server IP/Name

Setting	Description	Factory Default
IP address of TFTP server	Specifies the IP address or name of the remote TFTP server. This IP address must be specified before downloading or uploading files.	None

Configuration Files Path and Name

Setting	Description	Factory Default
Max. 40 characters	Specifies the path and file name of the PT-7710's configuration file on the TFTP server.	None

Firmware Files Path and Name

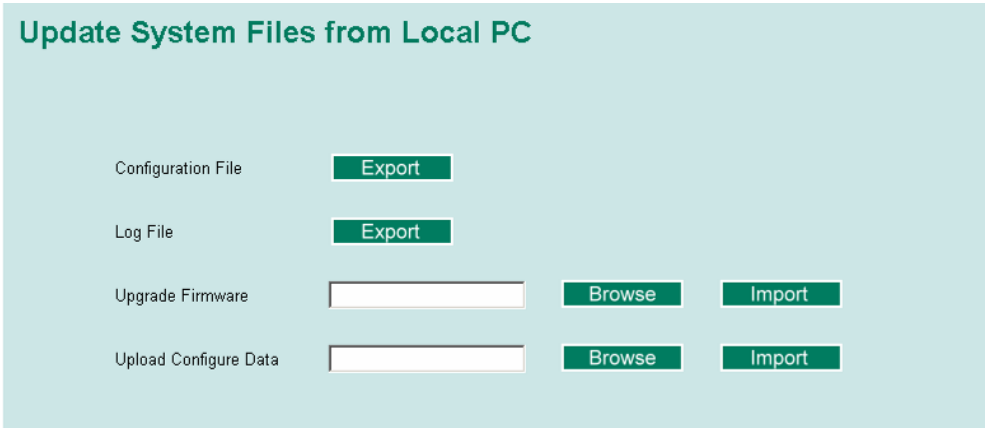
Setting	Description	Factory Default
Max. 40 characters	Specifies the path and file name of the PT-7710's firmware file.	None

Log Files Path and Name

Setting	Description	Factory Default
Max. 40 characters	Specifies the path and file name of the PT-7710's log file.	None

Click **Download** to download the prepared file from the remote TFTP server, or click **Upload** to upload the desired file to the remote TFTP server.

System File Update—By Local Import/Export



Configuration File

Click Export to save the PT-7710's configuration file to the local host.

Log File

Click **Export** to save the PT-7710's log file to the local host.

NOTE Some operating systems will open the configuration file and log file directly in the web page. In such cases, right click the Export button to save the file.

Upgrade Firmware

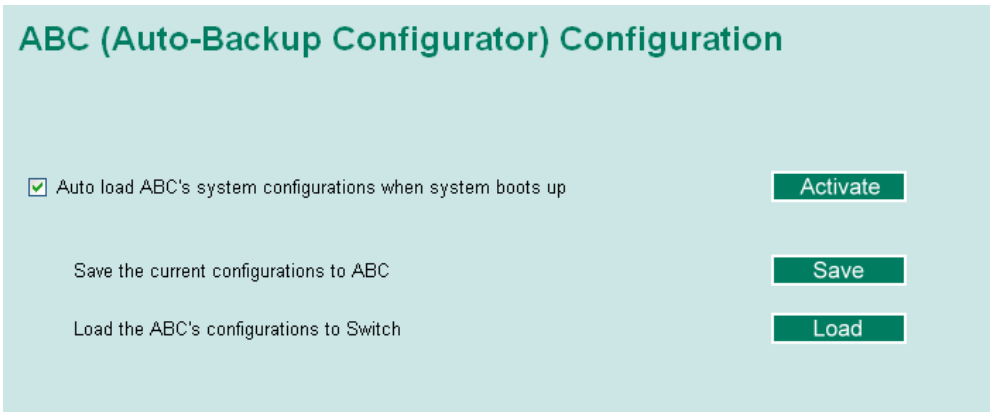
To import a new firmware file onto the PT-7710, click **Browse** to select the firmware file that is saved on your computer. The upgrade procedure will proceed automatically after clicking **Import**.

Upload Configure Data

To import a configuration file onto the PT-7710, click **Browse** to select the configuration file already saved on your computer. The upgrade procedure will proceed automatically after clicking **Import**.

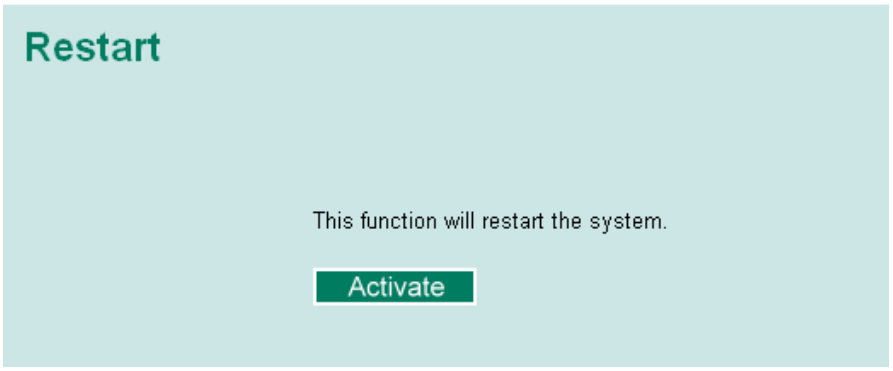
System File Update - By Backup Media

Users can use Moxa's Automatic Backup Configurator to save and load the PT-7710's configurations through the switch's RS-232 console port.


ABC (Auto-Backup Configurator) Configuration
Auto load ABC's system configurations when system boots up
Activate
Save the current configurations to ABC
Save
Load the ABC's configurations to Switch
Load

Restart

This function provides users with a quick way to restart the system.



Factory Default

Reset to Factory Default
This function will reset all settings to their factory default values.
Be aware that previous settings will be lost.
Activate

This function provides users with a quick way of restoring the PT-7710's configuration to factory defaults. This function is available in the serial, Telnet, and web consoles.

NOTE After restoring the factory default configuration, you will need to use the default network settings to re-establish the web or Telnet console connection with the PT-7710.

Using Port Trunks

Link aggregation involves grouping links to into a link aggregation group. A MAC client can treat link aggregation groups as if they were a single link.

The PT-7710's port trunk feature allows devices to communicate by aggregating up to 4 trunk groups, with a maximum of 8 ports for each group. If one of the 8 ports fails, the other seven ports will automatically provide backup and share the traffic.

Port trunks can be used to combine up to 8 ports between two PT-7710 switches. If all ports on both switch units are configured as 100BaseTX and they are operating in full duplex, the potential bandwidth of the connection will be 1600 Mbps.

The Port Trunk Concept

Moxa has developed a proprietary port trunk protocol that provides the following benefits:

More flexibility in setting up your network connections, since the bandwidth of a link can be doubled, tripled, or quadrupled.

- Redundancy—if one link is broken, the remaining trunked ports share the traffic within this trunk group.
- Load sharing—MAC client traffic may be distributed across multiple links.
- To avoid broadcast storms or loops in your network while configuring a trunk, first disable or disconnect all ports that you want to add to the trunk or remove from the trunk. After you finish configuring the trunk, enable or re-connect the ports.

If all ports on both switch units are configured as 100BaseTX and they are operating in full duplex mode, the potential bandwidth of the connection will be up to 1.6 Gbps. This means that users can double, triple, or quadruple the bandwidth of the connection by port trunking between two PT series switches.

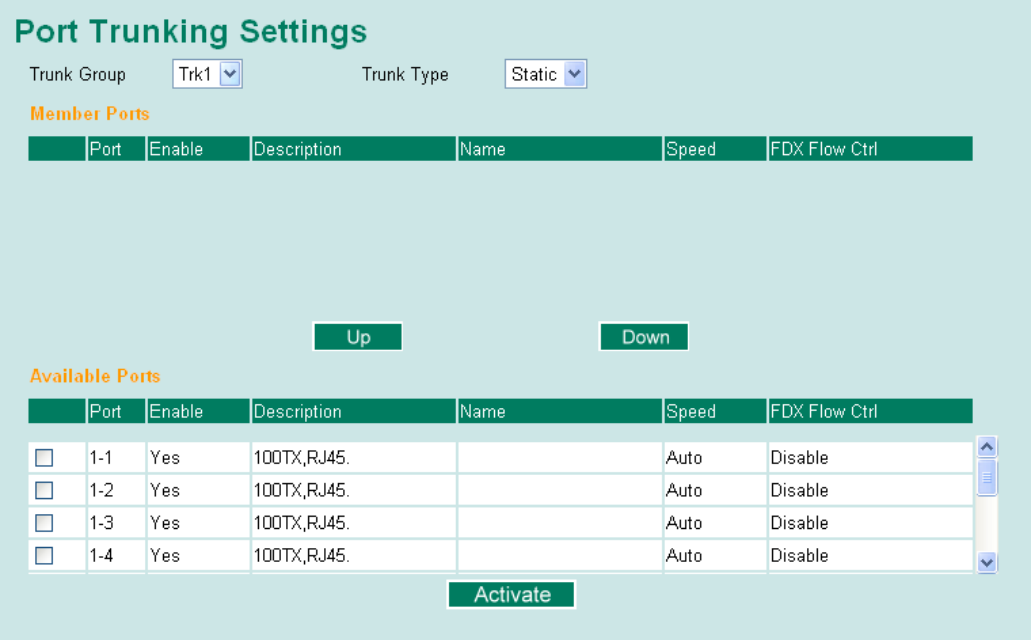
Each PT-7710 can set a maximum of 4 port trunk groups. When you activate port trunks, certain settings on each port will be reset to factory default values or disabled:

- Communication redundancy will be reset.
- 802.1Q VLAN will be reset.
- Multicast Filtering will be reset.
- Port Lock will be reset and disabled.
- Set Device IP will be reset.
- Mirror will be reset

After port trunks have been activated, you may configure these items again for each trunk port.

Configuring Port Trunks

The **Port Trunking Settings** page is where ports are assigned to a trunk group.



Step 1: Select the desired **Trunk Group** (Trk1, Trk2, Trk3, Trk4).

Step 2: Select the **Trunk Type** (Static or LACP).

Step 3: Select the desired ports under **Available Ports** and click **Up** to add to the Trunk Group.

Step 4: Select the desired ports under **Member Ports** and click **Down** to remove from the group.

Trunk Group (Maximum of 4 trunk groups)

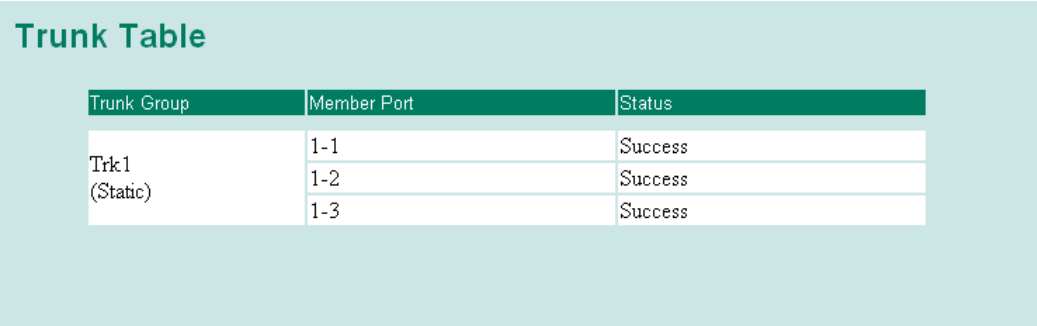
Setting	Description	Factory Default
Trk1, Trk2, Trk3, Trk4	Specifies the current trunk group.	Trk1

Trunk Type

Setting	Description	Factory Default
Static	Selects Moxa's proprietary trunk protocol.	Static
LACP	Selects LACP (IEEE 802.3ad, Link Aggregation Control Protocol).	Static

Available Ports/Member Ports

Setting	Description	Factory Default
Member/available ports	Lists the ports in the current trunk group and the ports that are available to be added.	N/A
Check box	Selects the port to be added or removed from the group.	Unchecked
Port	Indicates how each port is identified.	N/A
Port description	Displays the media type for each port.	N/A
Name	Displays the specified name for each port.	N/A
Speed	Indicates the transmission speed for each port (100M-Full, 100M-Half, 10M-Full, or 10M-Half).	N/A
FDX flow control	Indicates if the FDX flow control of this port is enabled or disabled.	N/A
Up	Used to add selected ports into the trunk group from available ports.	N/A
Down	Used to remove selected ports from the trunk group.	N/A



Trunk Table

Setting	Description
Trunk group	Displays the trunk type and trunk group.
Member port	Displays the member ports that belong to the trunk group.
Status	Success means the port trunk is working properly. Fail means the port trunk is not working properly. Standby means the port trunk is working as a standby port. When there are more than eight ports trunked as a trunk group, the 9th port will be the standby port.

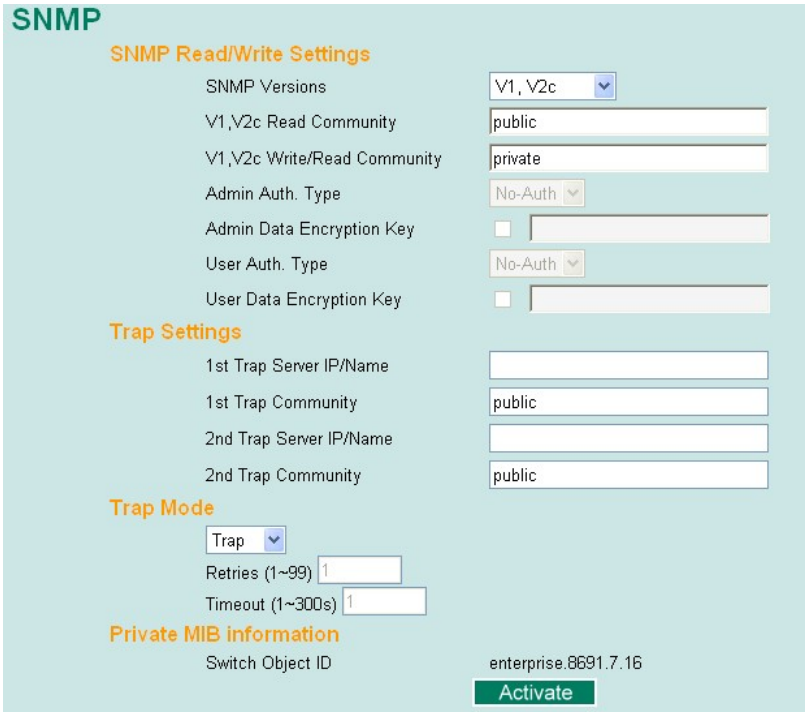
Configuring SNMP

The PT-7710 supports SNMP V1, V2c, and V3. SNMP V1 and SNMP V2c use a community string match for authentication, which means that SNMP servers access all objects with read-only or read/write permissions using the community strings *public* and *private* by default. SNMP V3 requires that you select an authentication level of MD5 or SHA, and is the most secure protocol. You can also enable data encryption to enhance data security.

Supported SNMP security modes and levels are shown in the following table. Select the security mode and level that will be used to communicate between the SNMP agent and manager.

Protocol Version	**UI Setting**	**Authentication**	**Encryption**	**Method**
SNMP V1, V2c	V1, V2c Read Community	Community string	No	Uses a community string match for authentication.
	V1, V2c Write/Read Community	Community string	No	Uses a community string match for authentication.
SNMP V3	No-Auth	No	No	Uses an account with admin or user to access objects
	MD5 or SHA	Authentication based on MD5 or SHA	No	Provides authentication based on HMAC-MD5, or HMAC-SHA algorithms. 8-character passwords are the minimum requirement for authentication.
	MD5 or SHA	Authentication based on MD5 or SHA	Data encryption key	Provides authentication based on HMAC-MD5 or HMAC-SHA algorithms, and data encryption key. 8-character passwords and a data encryption key are the minimum requirements for authentication .and encryption.

These parameters are configured on the SNMP page. A more detailed explanation of each parameter is given below the figure.



SNMP Read / Write Settings

SNMP Versions

Setting	Description	Factory Default
V1, V2c, V3, or V1, V2c, or V3 only	Specifies the SNMP protocol version used to manage the switch.	V1, V2c

V1, V2c Read Community

Setting	Description	Factory Default
Max. 30 characters	Specifies the community string to authenticate the SNMP agent for read-only access. The SNMP agent will access all objects with read-only permissions using this community string.	Public

V1, V2c Write/Read Community

Setting	Description	Factory Default
Max. 30 characters	Specifies the community string to authenticate the SNMP agent for read/write access. The SNMP server will access all objects with read/write permissions using this community string.	Private

For SNMP V3, there are two levels of privilege for different accounts to access the PT-7710. **Admin** privilege provides access and authorization to read and write the MIB file. **User** privilege allows reading of the MIB file only.

Admin Auth. Type (for SNMP V1, V2c, V3, and V3 only)

Setting	Description	Factory Default
No-Auth	Allows the admin account to access objects without authentication.	No
MD5-Auth	Authentication will be based on the HMAC-MD5 algorithm. 8-character passwords are the minimum requirement for authentication.	No
SHA-Auth	Authentication will be based on the HMAC-SHA algorithm. 8-character passwords are the minimum requirement for authentication.	No

Admin Data Encryption Key (for SNMP V1, V2c, V3, and V3 only)

Setting	Description	Factory Default
Enable	Enables data encryption using the specified data encryption key (between 8 and 30 characters).	No
Disable	Specifies that data will not be encrypted.	No

User Auth. Type (for SNMP V1, V2c, V3 and V3 only)

Setting	Description	Factory Default
No-Auth	Allows the admin account and user account to access objects without authentication.	No
MD5-Auth	Authentication will be based on the HMAC-MD5 algorithm. 8-character passwords are the minimum requirement for authentication.	No
SHA-Auth	Authentication will be based on the HMAC-SHA algorithm. 8-character passwords are the minimum requirement for authentication.	No

User Data Encryption Key (for SNMP V1, V2c, V3 and V3 only)

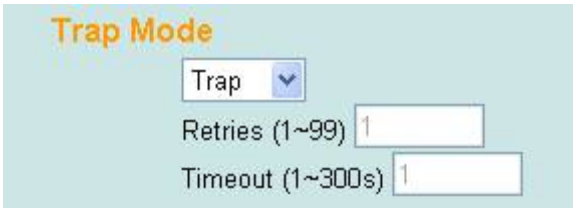
Setting	Description	Factory Default
Enable	Enables data encryption using the specified data encryption key (between 8 and 30 characters).	No
Disable	No data encryption	No

Trap Settings

SNMP traps allow an SNMP agent to notify the NMS of a significant event. The EDS-600 supports two SNMP modes, **Trap** mode and **Inform** mode.

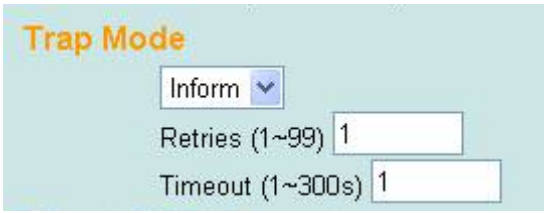
SNMP Trap Mode

In **Trap** mode, the SNMP agent sends an SNMPv1 trap PDU to the NMS. No acknowledgment is sent back from the NMS so the agent has no way of knowing if the trap reached the NMS.



SNMP Inform Mode

SNMPv2 provides an inform mechanism. When an inform message is sent from the SNMP agent to the NMS, the receiver sends a response to the sender acknowledging receipt of the event. This behavior is similar to that of the get and set requests. If the SNMP agent doesn't receive a response from the NMS for a period of time, the agent will resend the trap to the NMS agent. The maximum timeout time is 300 secs (default is 1 sec), and the maximum number of retries is 99 times (default is 1 time). When the SNMP agent receives acknowledgement from the NMS, it will stop resending the inform messages.



1st Trap Server IP/Name

Setting	Description	Factory Default
IP or name	Specifies the IP address or name of the primary trap server used by your network.	None

1st Trap Community

Setting	Description	Factory Default
Max. 30 characters	Specifies the community string to use for authentication.	Public

2nd Trap Server IP/Name

Setting	Description	Factory Default
IP or name	Specifies the IP address or name of the secondary trap server used by your network.	None

2nd Trap Community

Setting	Description	Factory Default
Max. 30 characters	Specifies the community string to use for authentication.	Public

Trap Mode

Setting	Description	Factory Default
Trap	Select this option to use SNMP Trap message to indicate event occurrence.	Trap
Inform	Select this option to use SNMP Inform messages to indicate event occurrence. SNMPv2 provides an inform mechanism. When an inform message is sent from the SNMP agent to the NMS (network management system), the receiver sends a response to the sender acknowledging receipt of the event. This behavior is similar to that of the get and set requests.	Trap

Retries (1-99)

Setting	Description	Factory Default
1 to 99	The maximum number of retries is 99 times (default is 1 time). When the SNMP agent receives acknowledgement from the NMS, it will stop resending the inform messages.	Disable when Trap Mode is “Trap”, 1 when Trap Mode is “Inform”.

Timeout (1-300s)

Setting	Description	Factory Default
1 to 300	If the SNMP agent doesn’t receive a response from the NMS for a period of time, the agent will resend the SNMP trap message to the NMS agent. The maximum timeout time is 300 secs (default is 1 sec).	Disable when Trap Mode is “Trap”, 1 when Trap Mode is “Inform”.

Private MIB information

Switch Object ID

Setting	Description	Factory Default
8691.7.16	Indicates the PT-7710’s enterprise value.	Fixed

NOTE: The Switch Object ID cannot be changed.

Using Network Redundancy

Employing network redundancy on your network helps protect critical links against failure, prevents network loops, and keeps network downtime at a minimum.

Network redundancy allows the user to set up *redundant loops* in a network to provide a backup data transmission route in the event that a cable is inadvertently disconnected or damaged. This is a particularly important feature for industrial applications, since it could take several minutes to locate a disconnected or severed cable. For example, in a production line, several minutes of downtime can result in substantial losses in production and revenue. The PT-7710 supports four different protocols for network redundancy—**Rapid Spanning Tree Protocol (IEEE-802.1w), Turbo Ring**, **Turbo Ring V2, and Turbo Chain.**

When configuring a redundant ring, all switches on the same ring must be configured using the same redundancy protocol. You cannot mix the Turbo Ring, Turbo Ring V2, Turbo Chain, and STP/RSTP protocols within the same ring. The following table lists the key differences between each protocol. Use this information to evaluate the benefits of each protocol, and then determine which one is most suitable for your network.

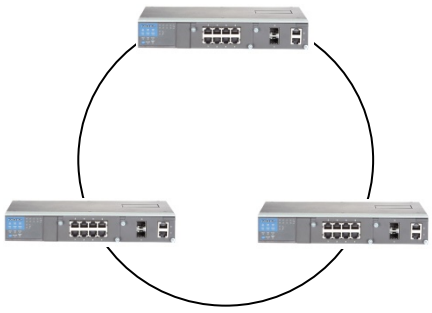
	Turbo Ring V2	Turbo Ring	Turbo Chain	STP	RSTP
Topology	Ring	Ring	Ring, Mesh	Ring, Mesh	Ring, Mesh
Recovery Time	< 20 ms	< 300 ms	< 20ms	Up to 30 sec.	Up to 5 sec

NOTE Most Moxa managed switches support two proprietary Turbo Ring protocols:
Turbo Ring refers to the original version of Moxa's proprietary redundant ring protocol, which has a recovery time of under 300 ms.
Turbo Ring V2 refers to the newer version of Turbo Ring, which has a recovery time of under 20 ms.

The Turbo Ring Concept

Moxa developed the proprietary Turbo Ring protocol to optimize communication redundancy and achieve a faster recovery time on the network.

The Turbo Ring and Turbo Ring V2 protocols designate one switch as the ***master*** of the network, and then automatically block packets from traveling through any of the network's redundant loops. In the event that one branch of the ring gets disconnected from the rest of the network, the protocol automatically readjusts the ring so that the part of the network that was disconnected can reestablish contact with the rest of the network.

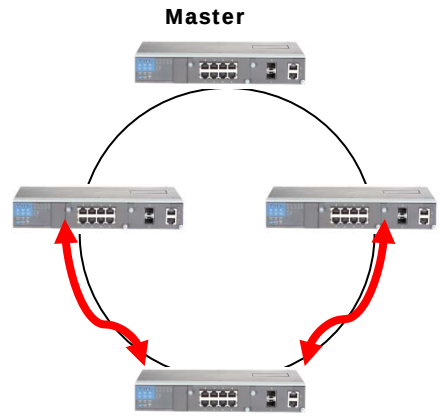
Initial setup for Turbo Ring or Turbo Ring V2	
	For each switch in the ring, select any two ports as the redundant ports. Connect redundant ports on neighboring switches to form the redundant ring.

The user does not need to manually assign the master with Turbo Ring or Turbo Ring V2. If no switch is assigned as the master, the protocol automatically selects one of the switches to be the master. The master is only used to identify which segment in the redundant ring acts as the backup path. In the following subsections, we explain how the redundant path is selected for rings configured for Turbo Ring and Turbo Ring V2.

Determining the Redundant Path for Turbo Ring

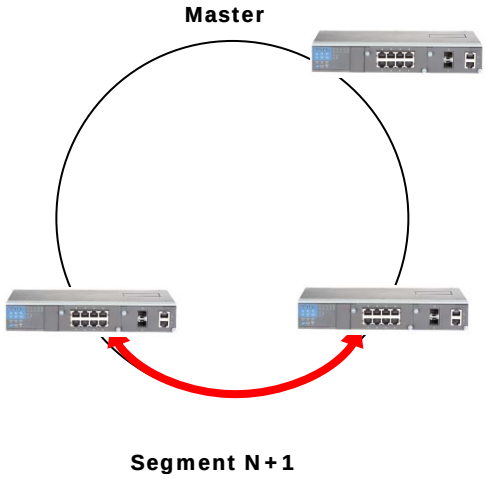
In this case, the redundant segment (i.e., the segment that will be blocked during normal operation) is determined by the number of PT series Ethernet switches in the ring and by the location of the master switch.

Turbo Ring with an even number of switches



If the number of Ethernet switches in the Turbo Ring is 2N (an even number), the backup segment is one of the two segments connected to the (N+1) st switch (i.e., the unit directly opposite the master).

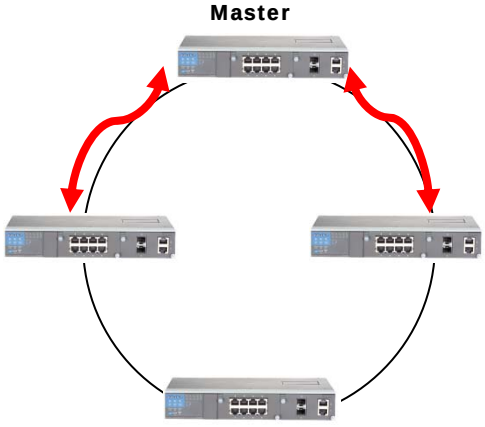
Turbo Ring with an odd number of switches



If the number of Ethernet switches in the Turbo Ring is 2N+1 (an odd number), the backup segment is the (N+1) st segment counting counterclockwise.

For the example shown here, N=1, so that N+1=2.

Determining the Redundant Path for Turbo Ring V2



For Turbo Ring V2, the backup segment is the segment connected to the 2nd redundant port on the master.

Please refer to Configuring Turbo Ring V2 later in this chapter.

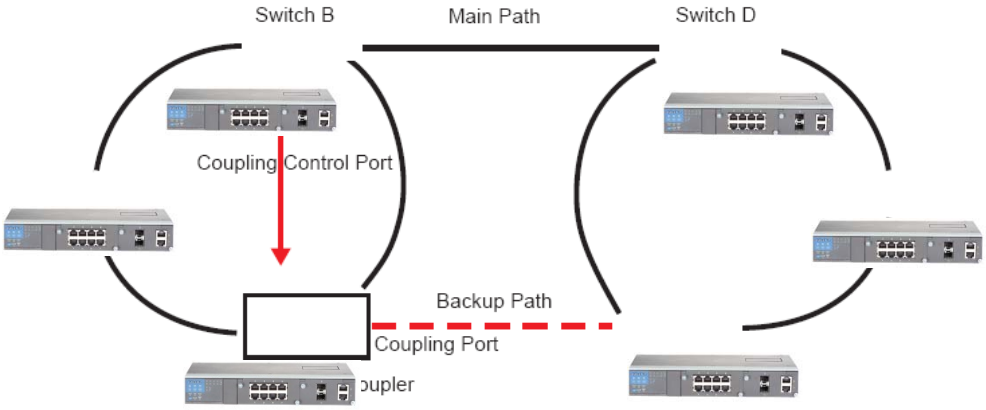
Ring Coupling Configuration

For some systems, it may not be convenient to connect all devices in the system in a single redundant ring, since some devices could be located in a remote area. For these systems, **Ring Coupling** can be used to group devices into smaller redundant rings that communicate with each other.

ATTENTION

In a VLAN environment, the user must set **Redundant Port Coupling Port** and **Coupling Control Port** to join all VLANs, since these ports act as the **backbone** to transmit all packets of different VLANs to the different PT series Ethernet switches.

Ring Coupling for Turbo Ring

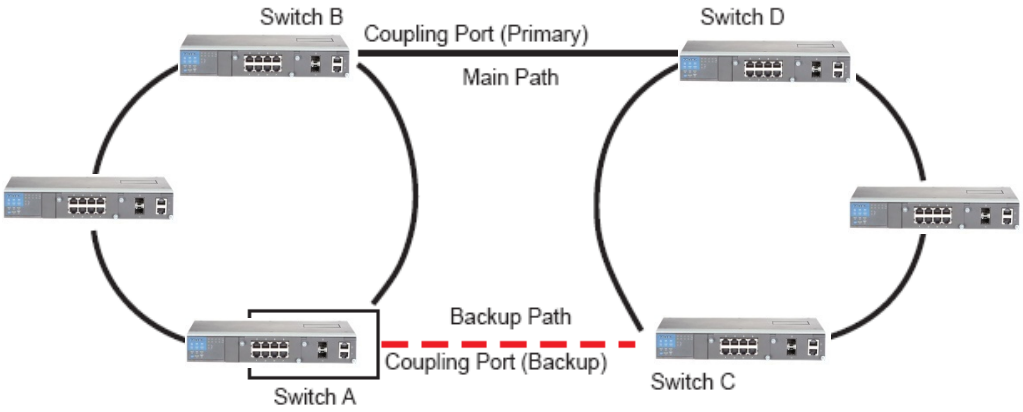


To configure the ring coupling for a **Turbo Ring**, select two PT series Ethernet switches (e.g., Switch A and B in the above figure) in the ring, and another two PT series Ethernet switches in the adjacent ring (e.g., Switch C and D).

Select two ports on each switch to be used as coupling ports and link them together. Next, assign one switch (e.g., Switch A) to be the **coupler** and connect the coupler's coupling control port with Switch B (for this example).

The coupler switch (i.e., Switch A) will monitor switch B through the coupling control port to determine whether or not the coupling port's backup path should be recovered.

Ring Coupling for Turbo Ring V2



Note that the ring coupling settings for a **Turbo Ring V2** are different from a **Turbo Ring**. For Turbo Ring V2, ring coupling is enabled by configuring the **Coupling Port (Primary)** on Switch B and the **Coupling Port (Backup)** on Switch A only. You do not need to set up a coupling control port, so **Turbo Ring V2** does not require a coupling control line.

The **Coupling Port (Backup)** on Switch A is used for the backup path and connects directly to a network port on Switch C. The **Coupling Port (Primary)** on Switch B monitors the status of the main path, and connects

directly to an extra network port on Switch D. With ring coupling established, Switch A can activate the backup path as soon as it detects a problem with the main path.

ATTENTION

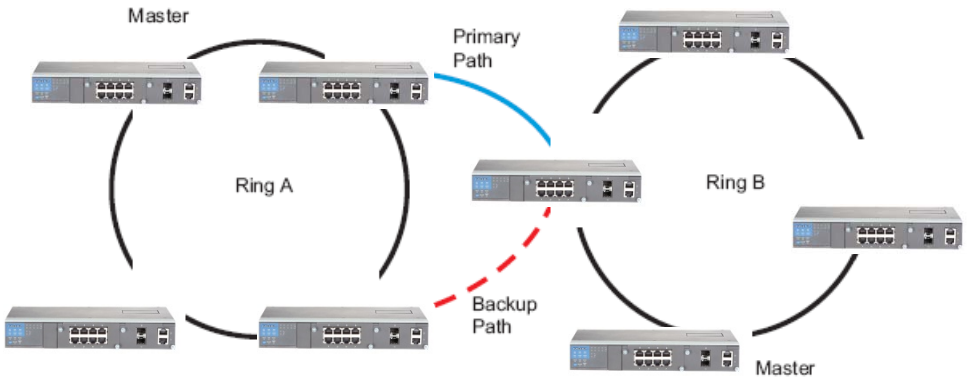
Ring coupling only needs to be enabled on one of the switches serving as the ring coupler. The coupler must assign separate ports for the two Turbo Ring ports and the coupling port.

NOTE You do not need to use the same PT series Ethernet switch for both ring coupling and ring master.

Dual-Homing Configuration for Turbo Ring V2

Dual-homing is only supported with Turbo Ring V2 and is used to connect two networks through a single Ethernet switch. The primary path is the operating connection, and the backup path is a back-up connection that is activated in the event that the primary path connection fails.

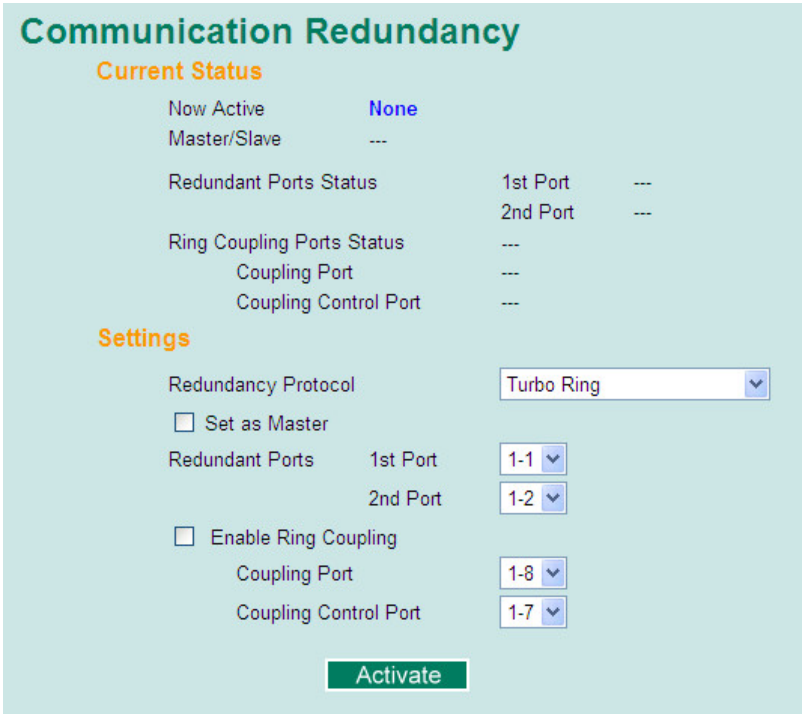
Dual-Homing for Turbo Ring V2



Configuring Turbo Ring and Turbo Ring V2

On the Communication Redundancy page, select Turbo Ring or Turbo Ring V2 as the Redundancy Protocol. Note that each protocol's configuration page is different.

Configuring Turbo Ring



"Current Status" Items

Now Active

This shows which communication protocol is in use: **Turbo Ring**, **Turbo Ring V2**, **RSTP**, **Turbo Chain**, or **none**.

Master/Slave

This indicates whether or not the PT-7710 is the master of the Turbo Ring. This field appears only for Turbo Ring or Turbo Ring V2.

NOTE The user does not need to assign the master to use Turbo Ring or Turbo Ring V2. If no master is assigned, the Turbo Ring protocol will automatically assign master status to one of the PT series Ethernet switches in the ring. The master is only used to determine which segment serves as the backup path.

Redundant Ports Status (1st Port, 2nd Port)

Ring Coupling Ports Status (Coupling Port, Coupling Control Port)

The **Ports Status** indicators show ***Forwarding*** for normal transmission, ***Blocking*** if the port is part of a backup path that is currently blocked, and ***Link down*** if there is no connection.

"Settings" Items

Redundancy Protocol

Setting	Description	Factory Default
Turbo Ring	Selects the Turbo Ring protocol.	None
Turbo Ring V2	Selects the Turbo Ring V2 protocol.	
RSTP (IEEE 802.1w/1D)	Selects the RSTP protocol.	
Turbo Chain	Selects the Turbo Chain protocol.	
None	Disables ring redundancy.	

Set as Master

Setting	Description	Factory Default
Enabled	The PT-7710 is manually selected as the master.	Not checked
Disabled	The Turbo Ring or Turbo Ring V2 protocol will automatically select the master.	

Redundant Ports

Setting	Description	Factory Default
1st Port	Specifies which port on the PT-7710 will be used as the first redundant port.	Port 1-1
2nd Port	Specifies which port on the PT-7710 will be used as the second redundant port.	Port 1-2

Enable Ring Coupling

Setting	Description	Factory Default
Enable	Specifies that this PT-7710 will be a ring coupler.	Not checked
Disable	Specifies that this PT-7710 is not a ring coupler.	

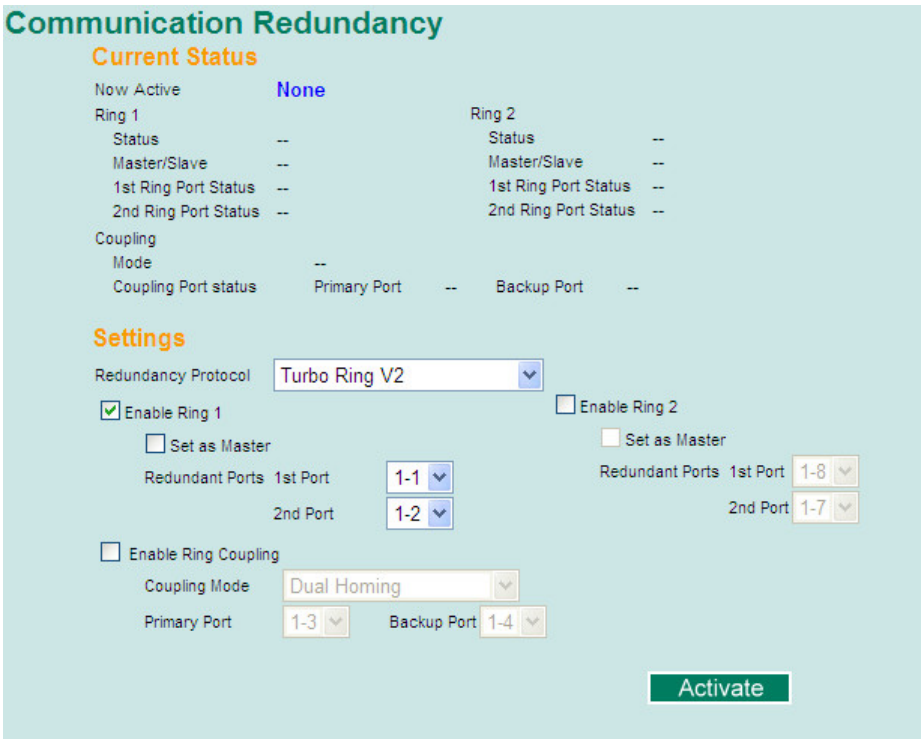
Coupling Port

Setting	Description	Factory Default
Coupling Port	Specifies which port on the PT-7710 will be used as the coupling port.	Port 1-8

Coupling Control Port

Setting	Description	Factory Default
Coupling Control Port	Specifies which port on the PT-7710 will be used as the coupling control port.	Port 1-7

Configuring Turbo Ring V2



NOTE When using dual-ring architecture, users must complete configuration for both Ring 1 and Ring 2. The status of both rings will appear under Current Status.

"Current Status" Items

Now Active

This shows which communication protocol is in use: **Turbo Ring**, **Turbo Ring V2**, **RSTP**, **Turbo Chian** or **none**.

Ring 1/2—Status

This shows **Healthy** if the ring is operating normally, and shows **Break** if the ring's backup link is active.

Ring 1/2—Master/Slave

This indicates whether or not the PT-7710 is the master of the Turbo Ring. This field appears only when selected to operate in Turbo Ring or Turbo Ring V2 mode.

NOTE The user does not need to assign the master to use Turbo Ring or Turbo Ring V2. If no master is assigned, the Turbo Ring protocol will automatically assign master status to one of the PT series Ethernet switches in the ring. The master is only used to determine which segment serves as the backup path.

Ring 1/2—1st Ring Port Status

Ring 1/2—2nd Ring Port Status

The **Ports Status** indicators show ***Forwarding*** for normal transmission, ***Blocking*** if this port is connected to a backup path and the path is blocked, and ***Link down*** if there is no connection.

Coupling—Mode

This indicates either **None**, **Dual Homing**, or **Ring Coupling**.

Coupling—Coupling Port status

This indicates either **Primary**, or **Backup**.

"Settings" Items

Redundancy Protocol

Setting	Description	Factory Default
Turbo Ring	Selects the Turbo Ring protocol.	None
Turbo Ring V2	Selects the Turbo Ring V2 protocol.	
Turbo Chain	Selects the Turbo Chain protocol.	
RSTP (IEEE 802.1w/1D)	Selects the RSTP protocol.	
None	Disables ring redundancy.	

Enable Ring 1

Setting	Description	Factory Default
Enabled	Enables Ring 1.	Not checked
Disabled	Disables Ring 1.	

Enable Ring 2*

Setting	Description	Factory Default
Enabled	Enables Ring 2.	Not checked
Disabled	Disables Ring 2.	

***Both Ring 1 and Ring 2 must be enabled when using the dual-ring architecture.**

Set as Master

Setting	Description	Factory Default
Enabled	The PT-7710 is manually selected as the master.	Not checked
Disabled	The Turbo Ring or Turbo Ring V2 protocol will automatically select the master.	

Redundant Ports

Setting	Description	Factory Default
1st Port	Specifies which port on the PT-7710 will be used as the first redundant port.	Port 1-1
2nd Port	Specifies which port on the PT-7710 will be used as the second redundant port.	Port 1-2

Enable Ring Coupling

Setting	Description	Factory Default
Enable	Specifies that this PT-7710 will be a ring coupler.	Not checked
Disable	Specifies that this PT-7710 is not a ring coupler.	

Coupling Mode

Setting	Description	Factory Default
Dual Homing	Enables dual homing through the PT-7710.	None
Ring Coupling (backup)	Specifies that the PT-7710 will be used for a ring coupling backup connection.	Port 1-3
Ring Coupling (primary)	Specifies that the PT-7710 will be used for a ring coupling primary connection.	Port 1-4

Primary/Backup Port

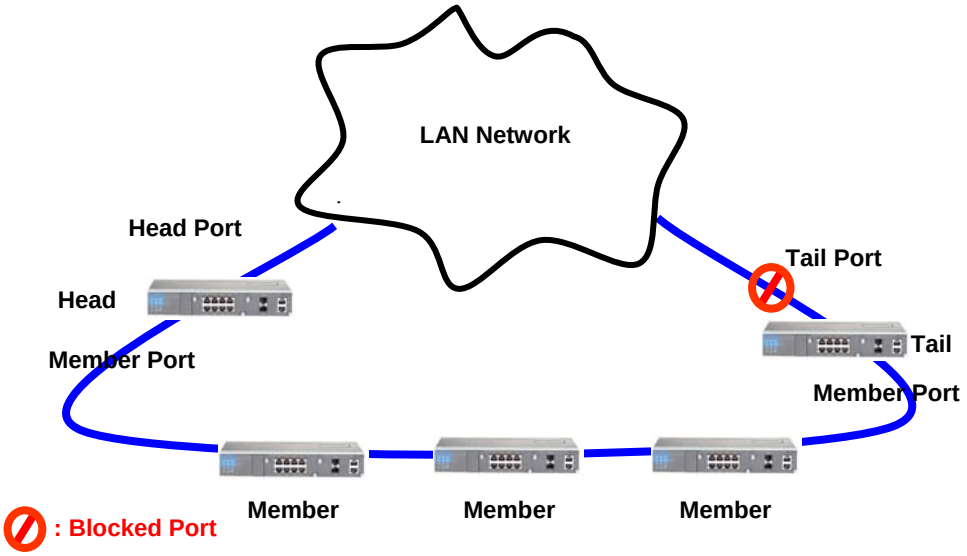
Setting	Description	Factory Default
Primary Port	Specifies which port on the PT-7710 will be used as primary port.	Port 1-3
Backup Port	Specifies which port on the PT-7710 will be used as the backup port.	Port 1-3

The Turbo Chain Concept

Moxa's Turbo Chain is an advanced software technology that gives network administrators the flexibility to construct any type of redundant network topology. When using a Turbo Chain, you first connect the Ethernet switches in a chain and then simply link the two ends of the chain to an Ethernet network, as illustrated in the following figure.

Turbo Chain can be used on industrial networks that have a complex topology. If the industrial network uses a multi-ring architecture, Turbo Chain can be used to create flexible and scalable topologies with a fast media recovery time.

Setting up Turbo Chain

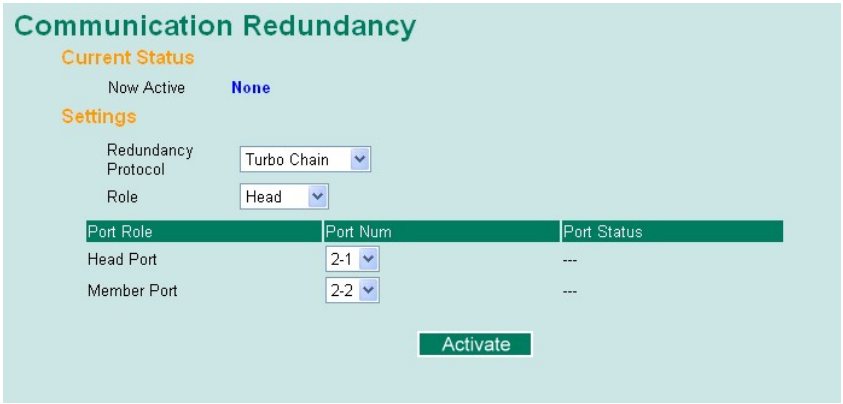


1. Select the Head Switch, Tail Switch, and Member Switches.
2. Configure one port as the Head port and one port as the Member port in the Head switch, configure one port as the Tail port and one port as the Member port in the Tail switch, and configure two ports as Member ports in each of the Member switches.
3. Connect the Head switch, Tail switch, and Member switches as shown in the diagram.

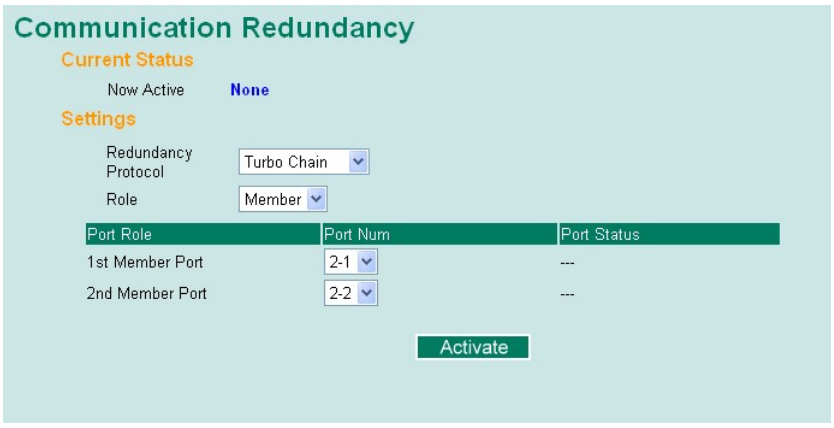
The path connected to the Head port is the main path, and the path connected to the Tail port is the backup path of the Turbo Chain. Normally, packets are transmitted through the Head Port to the LAN Network. If any Turbo Chain path is disconnected, the Tail Port will be activated to continue packet transmissions.

Configuring Turbo Chain

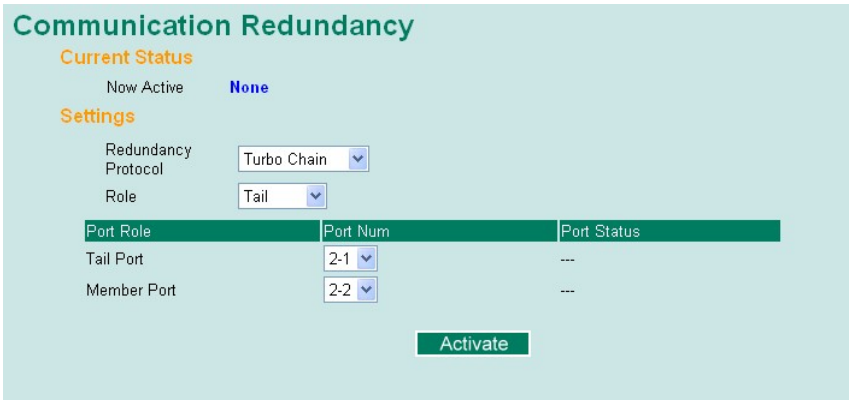
Head Switch Configuration



Member Switch Configuration



Tail Switch Configuration



"Current Status" Items

Now Active

Shows which communication protocol is in use: **Turbo Ring**, **Turbo Ring V2**, **RSTP**, **Turbo Chain** or **None**.

"Settings" Items

Redundancy Protocol

Setting	Description	Factory Default
Turbo Ring	Selects the Turbo Ring protocol.	None
Turbo Ring V2	Selects the Turbo Ring V2 protocol.	
Turbo Chain	Selects the Turbo Chain protocol.	
RSTP (IEEE 802.1W/1D)	Selects the RSTP protocol.	
None	Disables ring redundancy.	

Role

Setting	Description	Factory Default
Head	Selects this switch as the Head Switch	Member
Member	Selects this switch as Member Switch	
Tail	Selects this switch as Tail Switch	

Head Role

Setting	Description	Factory Default
Head Port	Selects any port of the switch to be the head port.	Port 2-1
Member Port	Selects any port of the switch to be the member port.	Port 2-2

Member Role

Setting	Description	Factory Default
1st Member port	Selects any port of the switch to be the 1st member port	Port 2-1
2nd Member port	Selects any port of the switch to be the 2nd member port	Port 2-2

Tail Role

Setting	Description	Factory Default
Tail Port	Selects any port of the switch to be the tail port.	Port 2-1
Member Port	Selects any port of the switch to be the member port.	Port 2-2

The STP / RSTP Concept

The Spanning Tree Protocol (STP) was designed to help reduce link failures in a network and provide protection from loops. Networks that have a complicated architecture are prone to broadcast storms caused by unintended loops in the network. The PT-7710's STP feature is disabled by default. To be completely effective, you must enable RSTP/STP on every PT-7710 connected to your network.

The Rapid Spanning Tree Protocol (RSTP) implements the Spanning Tree Algorithm and Protocol defined by IEEE Std 802.1D-2004. RSTP provides the following benefits:

- The topology of a bridged network will be determined much more quickly compared to STP.
- RSTP is backward compatible with STP, making it relatively easy to deploy. For example:

It defaults to sending 802.1D style BPDUs if packets with this format are received.

STP (802.1D) and RSTP (802.1w) can operate on different ports of the same PT-7710. This feature is particularly helpful when PT-7710 ports connect to older equipment, such as legacy switches.

You get essentially the same functionality with RSTP and STP. To see how the two systems different, please refer to *Differences between RSTP and STP* later in this chapter.

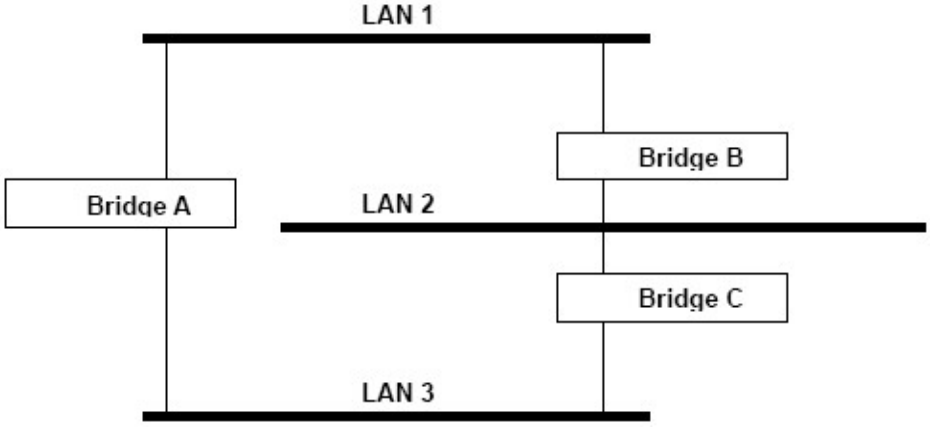
NOTE The STP protocol is part of the IEEE Std 802.1D, 2004 Edition bridge specification. The explanation given below uses bridge instead of switch.

What is STP?

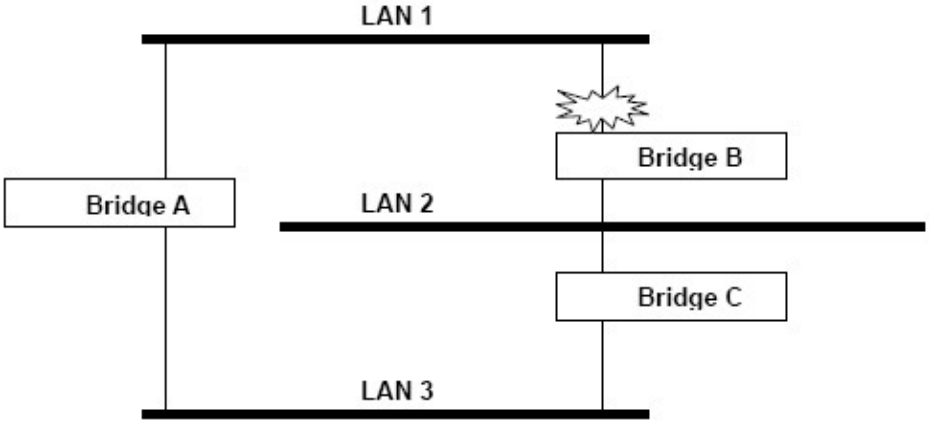
STP (802.1D) is a bridge-based system that is used to implement parallel paths for network traffic. STP uses a loop-detection process to:

- Locate and then disable less efficient paths (i.e., paths that have a lower bandwidth)
- Enable one of the less efficient paths if the most efficient path fails

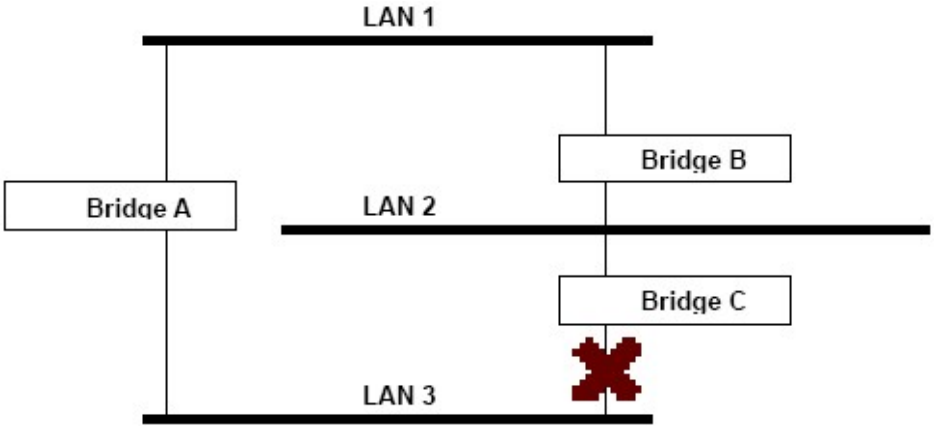
The figure below shows a network made up of three LANs separated by three bridges. Each segment uses at most two paths to communicate with the other segments. Since this configuration can give rise to loops, the network will overload if STP is not enabled.



If STP is enabled, it will detect duplicate paths and prevent, or block, one of them from forwarding traffic. In the following example, STP determined that traffic from LAN segment 2 to LAN segment 1 should flow through Bridges C and A because this path has a greater bandwidth and is therefore more efficient.



What happens if a link failure is detected? As shown in next figure, the STP process reconfigures the network so that traffic from LAN segment 2 flows through Bridge B.



STP will determine which path between each bridged segment is most efficient, and then assign a specific reference point on the network. When the most efficient path has been identified, the other paths are blocked. In the above 3 figures, STP first determined that the path through Bridge C was the most efficient, and as a result, blocked the path through Bridge B. After the failure of Bridge C, STP re-evaluated the situation and opened the path through Bridge B.

How STP Works

When enabled, STP determines the most appropriate path for traffic through a network. The method is described below:

STP Requirements

Before STP can configure the network, the system must satisfy the following requirements:

- Communication must be established between all bridges. This communication is carried out using Bridge Protocol Data Units (BPDUs), which are transmitted in packets with a known multicast address.
- Each bridge must have a Bridge Identifier that specifies which bridge acts as the central reference point, or Root Bridge, for the STP system. Bridges with a lower Bridge Identifier are more likely to be designated as the Root Bridge. The Bridge Identifier is calculated using the MAC address of the bridge and a priority defined for the bridge. The default priority of PT-7710 is 32768.
- Each port has a cost that specifies the efficiency of each link. The efficiency cost is usually determined by the bandwidth of the link, with less efficient links assigned a higher cost. The following table shows the default port costs for a switch:

Port Speed	Path Cost 802.1D, 1998 Edition	Path Cost 802.1w-2001
10 Mbps	100	2,000,000
100 Mbps	19	200,000
1000 Mbps	4	20,000

STP Calculation

The first step of the STP process is to perform calculations. During this stage, each bridge on the network transmits BPDUs. The following items will then be calculated:

- The bridge that will act as the Root Bridge. The Root Bridge is the central reference point from which the network is configured.
- The Root Path Costs for each bridge. This is the cost of the paths from each bridge to the Root Bridge.
- The identity of each bridge's Root Port. The Root Port is the port on the bridge that connects to the Root Bridge via the most efficient path. In other words, this port connects to the Root Bridge via the path with the lowest Root Path Cost. The Root Bridge itself does not have a Root Port.
- The identity of the Designated Bridge for each LAN segment. The Designated Bridge is the bridge with the lowest Root Path Cost from that segment. If several bridges have the same Root Path Cost, the one with the lowest Bridge Identifier becomes the Designated Bridge. Traffic transmitted in the direction of the Root Bridge will flow through the Designated Bridge. The port on this bridge that connects to the segment is called the Designated Bridge Port.

STP Configuration

After all the bridges on the network agree on the identity of the Root Bridge and all relevant parameters have been established, each bridge is configured to forward traffic only between its Root Port and the Designated Bridge Ports for their respective network segments. All other ports are blocked, which means that they will not be allowed to receive or forward traffic.

STP Reconfiguration

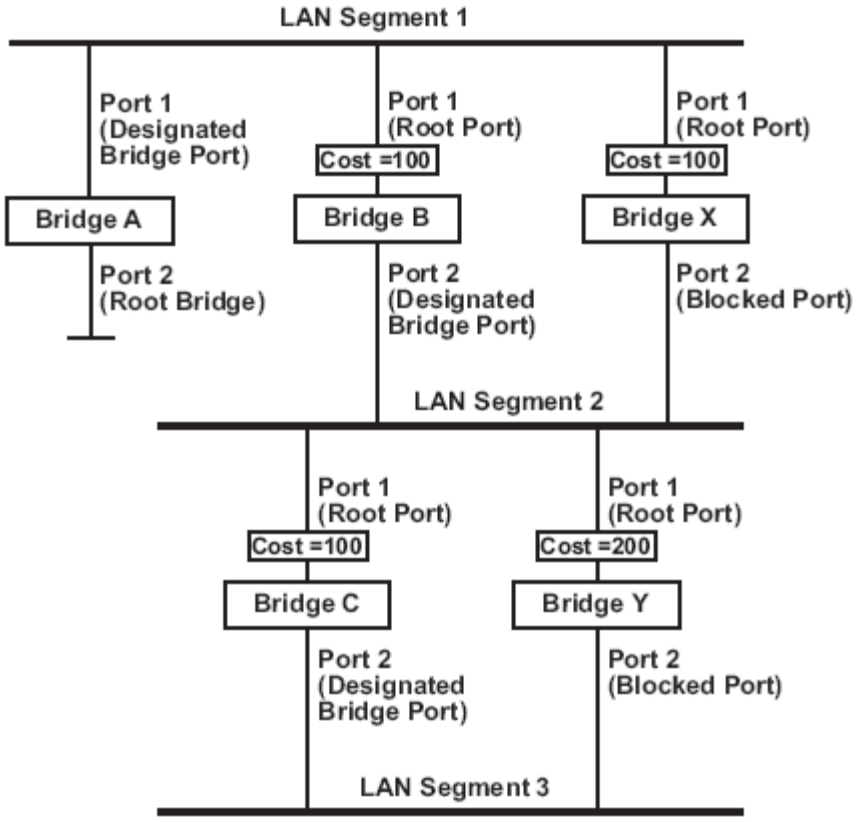
Once the network topology has stabilized, each bridge listens for "Hello" BPDUs that are transmitted from the Root Bridge at regular intervals. If a bridge does not receive a "Hello" BPDU after a certain interval (the Max Age time), the bridge assumes that the Root Bridge, or a link between itself and the Root Bridge, has gone down. This will trigger the bridge to reconfigure the network to account for the change. If you have configured an SNMP trap destination, the first bridge to detect a topology change in your network sends out an SNMP trap.

Differences between RSTP and STP

RSTP is similar to STP, but includes additional information in the BPDUs that allow each bridge to confirm that it has taken action to prevent loops from forming when it decides to enable a link to a neighboring bridge. Adjacent bridges connected via point-to-point links will be able to enable a link without waiting to ensure that all other bridges in the network have had time to react to the change. The main benefit of RSTP is that the configuration decision is made locally rather than network-wide, allowing RSTP can carry out automatic configuration and restore a link faster than STP.

STP Example

The LAN shown below has three segments, with adjacent segments connected using two possible links. The various STP factors, such as Cost, Root Port, Designated Bridge Port, and Blocked Port are shown in the figure.

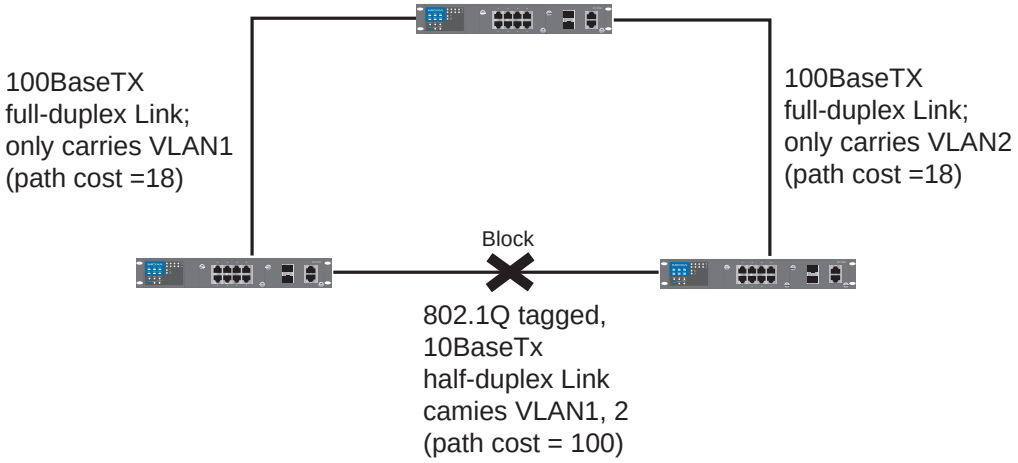


- Bridge A has been selected as the Root Bridge, since it was determined to have the lowest Bridge Identifier on the network.
- Since Bridge A is the Root Bridge, it is also the Designated Bridge for LAN segment 1. Port 1 on Bridge A is selected as the Designated Bridge Port for LAN Segment 1.
- Ports 1 of Bridges B, C, X, and Y are all Root Ports sine they are nearest to the Root Bridge, and therefore have the most efficient path.
- Bridges B and X offer the same Root Path Cost for LAN segment 2. However, Bridge B was selected as the Designated Bridge for that segment since it has a lower Bridge Identifier. Port 2 on Bridge B is selected as the Designated Bridge Port for LAN Segment 2.
- Bridge C is the Designated Bridge for LAN segment 3, because it has the lowest Root Path Cost for LAN Segment 3:
  - The route through Bridges C and B costs 200 (C to B=100, B to A=100)
  - The route through Bridges Y and B costs 300 (Y to B=200, B to A=100)
- The Designated Bridge Port for LAN Segment 3 is Port 2 on Bridge C.

Using RSTP on a Network with Multiple VLANs

IEEE Std 802.1D, 2004 Edition, does not take into account VLANs when calculating RSTP information—the calculations only depend on the physical connections. Consequently, some network configurations will result in VLANs being subdivided into a number of isolated sections by the RSTP system. You must ensure that every VLAN configuration on your network takes into account the expected RSTP topology and alternative topologies that may result from link failures.

The following figure shows an example of a network that contains VLANs 1 and 2. The VLANs are connected using the 802.1Q-tagged link between Switch B and Switch C. By default, this link has a port cost of 100 and is automatically blocked because the other Switch-to-Switch connections have a port cost of 36 (18+18). This means that both VLANs are now subdivided—VLAN 1 on Switch units A and B cannot communicate with VLAN 1 on Switch C, and VLAN 2 on Switch units A and C cannot communicate with VLAN 2 on Switch B.

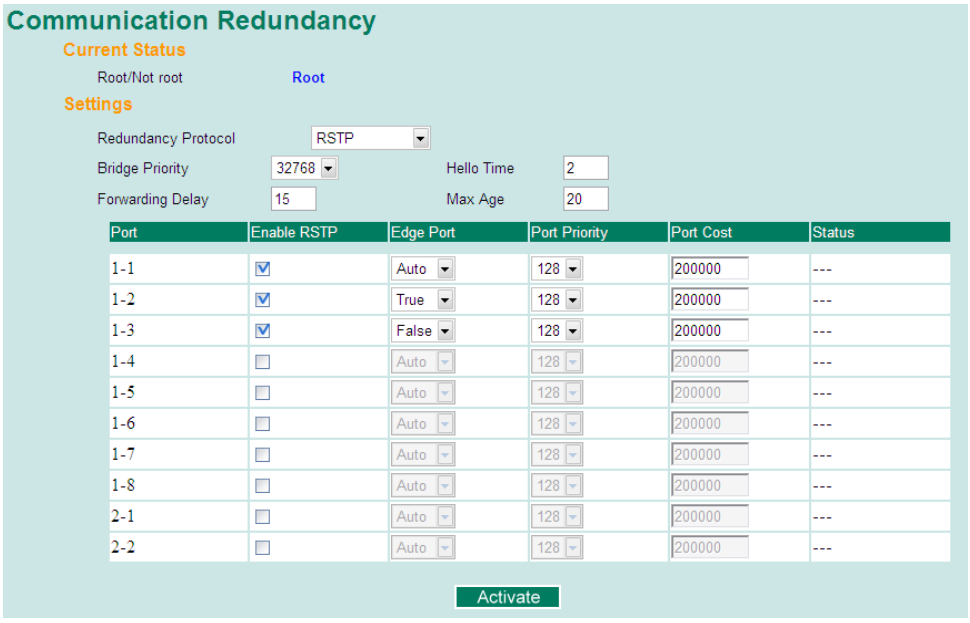


To avoid subdividing VLANs, all inter-switch connections should be made members of all available 802.1Q VLANs. This will ensure connectivity at all times. For example, the connections between Switches A and B, and between Switches A and C should be 802.1Q tagged and carrying VLANs 1 and 2 to ensure connectivity.

See the **Configuring Virtual LANs** section for more information about VLAN Tagging.

Configuring STP / RSTP

The following figures indicate which Spanning Tree Protocol parameters can be configured. A more detailed explanation of each parameter is given below the figure.



At the top of this page, the user can check the **Current Status** of this function. For RSTP, you will see:

Now Active:

This field shows which communication protocol is being used: Turbo Ring, Turbo Ring V2, Turbo Chain, RSTP, or none.

Root / Not Root

This field appears only for RSTP mode. It indicates whether or not this PT-7710 is the Root of the Spanning Tree (the root is determined automatically).

At the bottom of this page, the user can configure the **Settings** for the selected protocol. For RSTP, you can configure:

Protocol of Redundancy

Setting	Description	Factory Default
Turbo Ring	Selects the Turbo Ring protocol.	None
Turbo Ring V2	Selects the Turbo Ring V2 protocol.	None
Turbo Chain	Selects the Turbo Chain protocol.	None
RSTP (IEEE 802.1w/1D)	Selects the RSTP protocol.	None

Bridge Priority

Setting	Description	Factory Default
Numerical value selected by user	Specifies the PT-7710's bridge priority. A lower number means a higher priority, which means a greater chance of being established as the root of the Spanning Tree topology.	32768

Forwarding Delay

Setting	Description	Factory Default
Numerical value input by user	Specifies the amount of time this device will wait before checking to see if it should change to a different state.	15 (sec.)

Hello Time (sec.)

Setting	Description	Factory Default
Numerical value input by user	Specifies the time interval between "hello" messages broadcast by the root of the Spanning Tree topology. The "hello" message is used to check if the topology is healthy.	2

Max. Age (sec.)

Setting	Description	Factory Default
Numerical value input by user	Specifies the amount of time to wait for a "hello" message from the root before the PT-7710 will reconfigure itself as a root. When two or more devices on the network are recognized as a root, the devices will renegotiate to set up a new Spanning Tree topology.	20

Enable RSTP per Port

Setting	Description	Factory Default
Enable/Disable	Includes the selected port as a node on the Spanning Tree topology.	Disabled

NOTE We suggest that you disable the Rapid Spanning Tree Protocol for ports that are connected directly to a device (PLC, RTU, etc.) as opposed to network equipment. This will prevent unnecessary negotiation.

Edge Port

An edge port is a port that is directly connected to end stations. The edge port automatically transitions to the forwarding state, and skips the listening and learning stages.

Setting	Description	Factory Default
Auto	Auto toggles between Edge mode and RSTP mode, depending on whether or not BPDU is being received	Enabled
True	Forced Edge mode	Disabled
False	Forced RSTP mode	Disabled

NOTE We recommend connecting the Turbo Chain Head Port and Tail Port to an RSTP port when Forced Edge mode is enabled.

Port Priority

Setting	Description	Factory Default
Numerical value selected by user	Specifies the port's priority as a node on the Spanning Tree topology. Lower values correspond to higher priority.	128

Port Cost

Setting	Description	Factory Default
Numerical value input by user	Specifies the port cost. Higher costs correspond to lower suitability as a node for the Spanning Tree topology.	200000

Port Status

Indicates the current Spanning Tree status of this port. **Forwarding** indicates normal transmission and **Blocking** indicates blocked transmission.

Configuration Limits of RSTP / STP

The Spanning Tree Algorithm places limits on three of the configuration items:

[Eq. 1]: 1 sec ≦ Hello Time ≦ 2 sec

[Eq. 2]: 6 sec ≦ Max. Age ≦ 40 sec

[Eq. 3]: 4 sec ≦ Forwarding Delay ≦ 30 sec

These three variables are further restricted by the following two inequalities:

[Eq. 4]: 2 * (Hello Time + 1 sec) ≦ Max. Age ≦ 2 * (Forwarding Delay – 1 sec)

The PT-7710's firmware will alert you immediately if any of these restrictions are violated. For example, suppose Hello Time = 2 sec, Max. Age = 6 sec, and Forwarding Delay = 4 sec. This does not violate Eqs. 1 through 3, but it violates Eq. 4:

2 * (Hello Time + 1 sec) = 6 sec, and 2 * (Forwarding Delay – 1 sec) = 6 sec.

***HINT*: Take the following steps to avoid guesswork:**

Step 1: Assign a value to **"Hello Time"** and then calculate the left most part of Eq. 4 to get the lower limit of **Max. Age**.

Step 2: Assign a value to **"Forwarding Delay"** and then calculate the right most part of Eq. 4 to get the upper limit for **Max. Age**.

Step 3: Assign a value to **Forwarding Delay** that satisfies the conditions in Eq. 3 and Eq. 4.

Using Traffic Prioritization

The PT-7710's traffic prioritization capability provides Quality of Service (QoS) to your network by making data delivery more reliable. You can prioritize traffic on your network to ensure that high priority data is transmitted with minimum delay. Traffic can be controlled by a set of rules to obtain the required Quality of Service for your network. The rules define different types of traffic and specify how each type should be treated as it passes through the switch. The PT-7710 can inspect both IEEE 802.1p/1Q layer 2 CoS tags, and even layer 3 TOS information to provide consistent classification of the entire network. The PT-7710's QoS capability improves the performance and determinism of industrial networks for mission critical applications.

The Traffic Prioritization Concept

What is Traffic Prioritization?

Traffic prioritization allows you to prioritize data so that time-sensitive and system-critical data can be transferred smoothly and with minimal delay over a network. The benefits of using traffic prioritization are:

- Improve network performance by controlling a wide variety of traffic and managing congestion.
- Assign priorities to different categories of traffic. For example, set higher priorities for time-critical or business-critical applications.
- Provide predictable throughput for multimedia applications, such as video conferencing or voice over IP, and minimize traffic delay and jitter.
- Improve network performance as the amount of traffic grows. This will save cost by reducing the need to keep adding bandwidth to the network.

How Traffic Prioritization Works

Traffic prioritization uses the four traffic queues that are present in your PT-7710 to ensure that high priority traffic is forwarded on a different queue from lower priority traffic. This is what provides Quality of Service (QoS) to your network.

The PT-7710 traffic prioritization uses two industry-standard methods:

- **IEEE 802.1D**—a layer 2 marking scheme.
- **Differentiated Services (DiffServ)**—a layer 3 marking scheme.

IEEE 802.1D Traffic Marking

The IEEE Std 802.1D, 1998 Edition marking scheme, which is an enhancement to IEEE Std 802.1D, enables Quality of Service on the LAN. Traffic service levels are defined in the IEEE 802.1Q 4-byte tag, which is used to carry VLAN identification as well as IEEE 802.1p priority information. The 4-byte tag immediately follows the destination MAC address and Source MAC address.

The IEEE Std 802.1D, 1998 Edition priority marking scheme assigns an IEEE 802.1p priority level between 0 and 7 to each frame. This determines the level of service that that type of traffic should receive. Refer to the table below for an example of how different traffic types can be mapped to the eight IEEE 802.1p priority levels.

IEEE 802.1p Priority Level	IEEE 802.1D Traffic Type
0	Best Effort (default)
1	Background
2	Standard (spare)
3	Excellent Effort (business critical)
4	Controlled Load (streaming multimedia)
5	Video (interactive media); less than 100 milliseconds of latency and jitter
6	Voice (interactive voice); less than 10 milliseconds of latency and jitter
7	Network Control Reserved traffic

Even though the IEEE 802.1D standard is the most widely used prioritization scheme in the LAN environment, it still has some restrictions:

- It requires an additional 4-byte tag in the frame, which is normally optional in Ethernet networks. Without this tag, the scheme cannot work.
- The tag is part of the IEEE 802.1Q header, so to implement QoS at layer 2, the entire network must implement IEEE 802.1Q VLAN tagging.

It is only supported on a LAN and not across routed WAN links, since the IEEE 802.1Q tags are removed when the packets pass through a router.

Differentiated Services (DiffServ) Traffic Marking

DiffServ is a Layer 3 marking scheme that uses the DiffServ Code Point (DSCP) field in the IP header to store the packet priority information. DSCP is an advanced intelligent method of traffic marking because you can choose how your network prioritizes different types of traffic. DSCP uses 64 values that map to user-defined service levels, allowing you to establish more control over network traffic.

Advantages of DiffServ over IEEE 802.1D are:

- Configure how you want your switch to treat selected applications and types of traffic by assigning various grades of network service to them.
- No extra tags are required in the packet.
- DSCP uses the IP header of a packet and therefore priority is preserved across the Internet.
- DSCP is backward compatible with IPV4 TOS, which allows operation with existing devices that use a layer 3 TOS enabled prioritization scheme.

Traffic Prioritization

The PT-7710 classifies traffic based on layer 2 of the OSI 7 layer model, and the switch prioritizes received traffic according to the priority information defined in the received packet. Incoming traffic is classified based upon the IEEE 802.1D frame and is assigned to the appropriate priority queue based on the IEEE 802.1p service level value defined in that packet. Service level markings (values) are defined in the IEEE 802.1Q 4-byte tag, and consequently traffic will only contain 802.1p priority markings if the network is configured with VLANs and VLAN tagging. The traffic flow through the switch is as follows:

A packet received by the PT-7710 may or may not have an 802.1p tag associated with it. If it does not, then it is given a default 802.1p tag (which is usually 0). Alternatively, the packet may be marked with a new 802.1p value, which will result in all knowledge of the old 802.1p tag being lost.

Because the 802.1p priority levels are fixed to the traffic queues, the packet will be placed in the appropriate priority queue, ready for transmission through the appropriate egress port. When the packet reaches the head of its queue and is about to be transmitted, the device determines whether or not the egress port is tagged for that VLAN. If it is, then the new 802.1p tag is used in the extended 802.1D header.

The PT-7710 will check a packet received at the ingress port for IEEE 802.1D traffic classification, and then prioritize it based upon the IEEE 802.1p value (service levels) in that tag. It is this 802.1p value that determines which traffic queue the packet is mapped to.

Traffic Queues

The PT-7710 hardware has multiple traffic queues that allow packet prioritization to occur. Higher priority traffic can pass through the PT-7710 without being delayed by lower priority traffic. As each packet arrives in the PT-7710, it passes through any ingress processing (which includes classification, marking/re-marking), and is then sorted into the appropriate queue. The switch then forwards packets from each queue.

The PT-7710 supports two different queuing mechanisms:

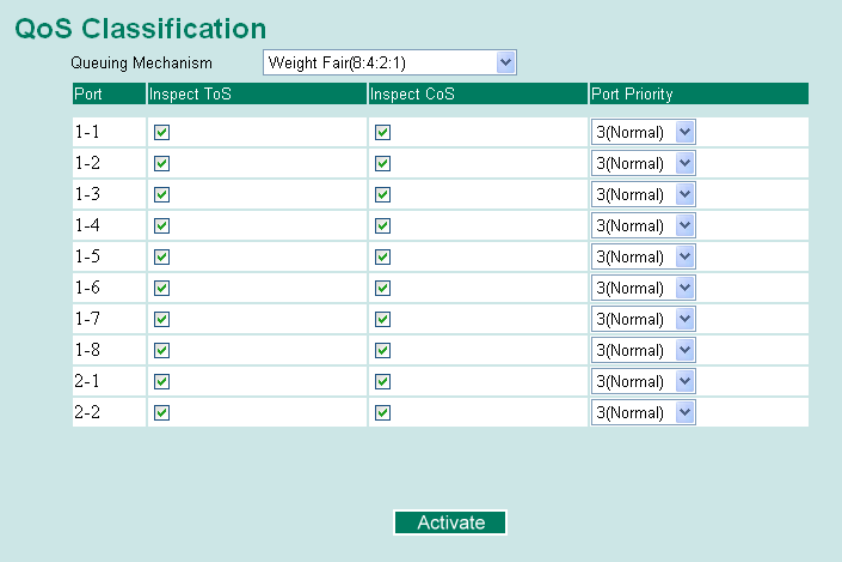
- **Weight Fair:** This method services all the traffic queues, giving priority to the higher priority queues. Under most circumstances, this method gives high priority precedence over low-priority, but in the event that high-priority traffic exceeds the link capacity, lower priority traffic is not blocked.
- **Strict:** This method services high traffic queues first; low priority queues are delayed until no more high priority data need to be sent. This method always gives precedence to high priority over low-priority.

Configuring Traffic Prioritization

Quality of Service (QoS) provides a traffic prioritization capability to ensure that important data is delivered consistently and predictably. The PT-7710 can inspect IEEE 802.1p/1Q layer 2 CoS tags, and even layer 3 TOS

information, to provide a consistent classification of the entire network. The PT-7710' QoS capability improves your industrial network's performance and determinism for mission critical applications.

QoS Classification



The PT-7710 supports inspection of layer 3 TOS and/or layer 2 CoS tag information to determine how to classify traffic packets.

Queuing Mechanism

Setting	Description	Factory Default
Weight Fair	The PT-7710 has 4 priority queues. In the weight fair scheme, an 8, 4, 2, 1 weighting is applied to the four priorities. This approach prevents the lower priority frames from being starved of opportunity for transmission with only a slight delay to the higher priority frames.	Weight Fair
Strict	In the Strict-priority scheme, all top-priority frames egress a port until that priority's queue is empty, and then the next lower priority queue's frames egress. This approach can cause the lower priorities to be starved of opportunity for transmitting any frames but ensures that all high priority frames to egress the switch as soon as possible.	

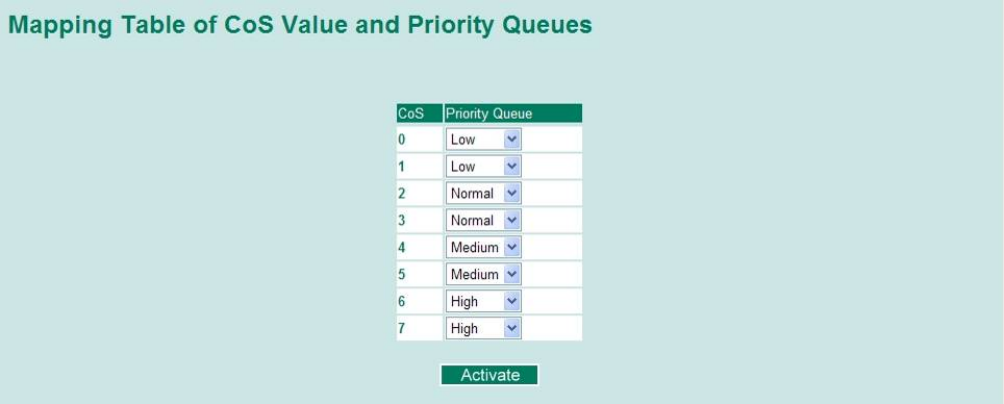
Inspect TOS

Setting	Description	Factory Default
Enable/Disable	Enables or disables the PT-7710 to inspect the Type of Service (TOS) bits in IPV4 frame to determine the priority of each frame.	Enable

Inspect COS

Setting	Description	Factory Default
Enable/Disable	Enables or disables the PT-7710 to inspect the 802.1p COS tag in the MAC frame to determine the priority of each frame.	Enable

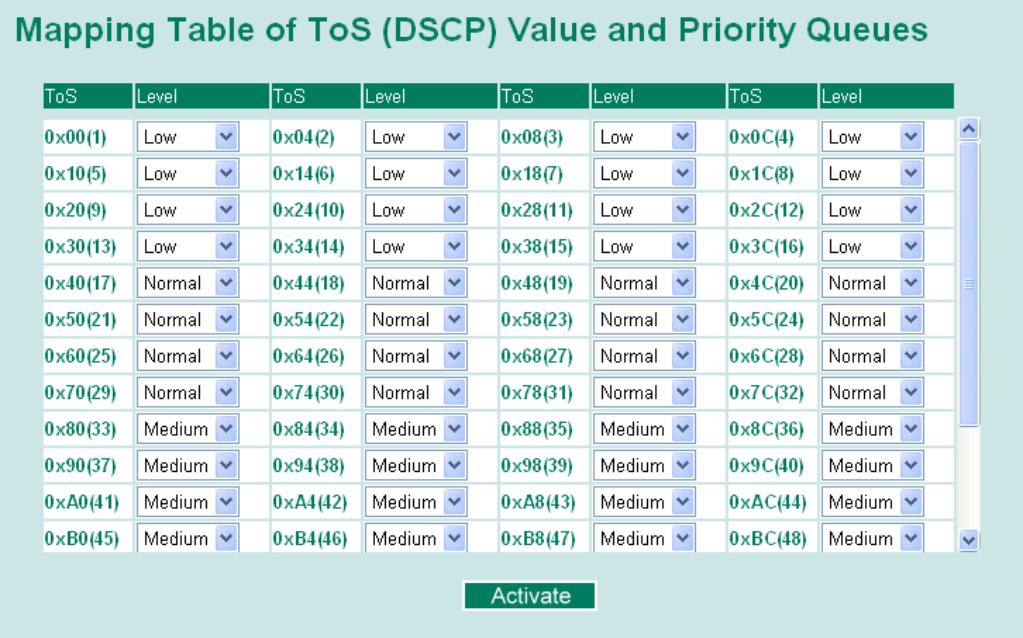
CoS Mapping



CoS Values and Priority Queues

Setting	Description	Factory
Low/Normal/ Medium/High	Maps different CoS values to 4 different egress queues.	0: Low 1: Low 2: Normal 3: Normal 4: Medium 5: Medium 6: High 7: High

TOS/DiffServ Mapping


Mapping Table of ToS (DSCP) Value and Priority Queues
ToS Level ToS Level ToS Level ToS Level
0x00(1) Low 0x04(2) Low 0x08(3) Low 0x0C(4) Low
0x10(5) Low 0x14(6) Low 0x18(7) Low 0x1C(8) Low
0x20(9) Low 0x24(10) Low 0x28(11) Low 0x2C(12) Low
0x30(13) Low 0x34(14) Low 0x38(15) Low 0x3C(16) Low
0x40(17) Normal 0x44(18) Normal 0x48(19) Normal 0x4C(20) Normal
0x50(21) Normal 0x54(22) Normal 0x58(23) Normal 0x5C(24) Normal
0x60(25) Normal 0x64(26) Normal 0x68(27) Normal 0x6C(28) Normal
0x70(29) Normal 0x74(30) Normal 0x78(31) Normal 0x7C(32) Normal
0x80(33) Medium 0x84(34) Medium 0x88(35) Medium 0x8C(36) Medium
0x90(37) Medium 0x94(38) Medium 0x98(39) Medium 0x9C(40) Medium
0xA0(41) Medium 0xA4(42) Medium 0xA8(43) Medium 0xAC(44) Medium
0xB0(45) Medium 0xB4(46) Medium 0xB8(47) Medium 0xBC(48) Medium
Activate

ToS (DSCP) Values and Priority Queues

Setting	Description	Factory Default
Low/Normal/ Medium/High	Maps different TOS values to 4 different egress queues.	1 to 16: Low 17 to 32: Normal 33 to 48: Medium 49 to 64: High

Using Virtual LAN

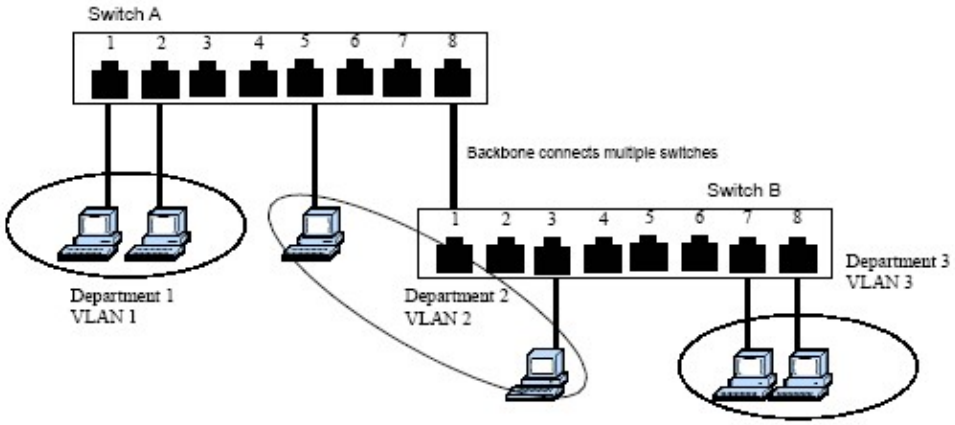
Setting up Virtual LANs (VLANs) on your PT-7710 increases the efficiency of your network by dividing the LAN into logical segments, as opposed to physical segments. In general, VLANs are easier to manage.

The Virtual LAN (VLAN) Concept

What is a VLAN?

A VLAN is a group of devices that can be located anywhere on a network, but which communicate as if they are on the same physical segment. With VLANs, you can segment your network without being restricted by physical connections—a limitation of traditional network design. As an example, with VLANs you can segment your network according to:

- **Departmental groups**—You could have one VLAN for the marketing department, another for the finance department, and another for the product development department.
- **Hierarchical groups**—You could have one VLAN for directors, another for managers, and another for general staff.
- **Usage groups**—You could have one VLAN for email users and another for multimedia users.



Benefits of VLANs

The main benefit of VLANs is that they provide a network segmentation system that is far more flexible than traditional networks. Using VLANs also provides you with three other benefits:

- **VLANs ease the relocation of devices on networks.** With traditional networks, network administrators spend much of their time dealing with moves and changes. If users move to a different subnetwork, the addresses of each host must be updated manually. With a VLAN setup, if a host on VLAN Marketing, for example, is moved to a port in another part of the network, and retains its original subnet membership, you only need to specify that the new port is on VLAN Marketing. You do not need to carry out any re-cabling.
- **VLANs provide extra security.** Devices within each VLAN can only communicate with other devices on the same VLAN. If a device on VLAN Marketing dept. to communicate with devices on VLAN Finance, the traffic must pass through a routing device or Layer 3 switch.
- **VLANs help control traffic.** With traditional networks, congestion can be caused by broadcast traffic that is directed to all network devices, regardless of whether or not they need it. VLANs increase the efficiency of your network because each VLAN can be set up to contain only those devices that need to communicate with each other.

VLANs and the PowerTrans

Your PT-7710 provides support for VLANs using IEEE Std 802.1Q-1998. This standard allows traffic from multiple VLANs to be carried across one physical link. The IEEE Std 802.1Q-1998 standard allows each port on your PT-7710 to be placed as follows:

- In a single VLAN defined on the PT-7710.
- In several VLANs simultaneously using 802.1Q tagging.

The standard requires that you define the *802.1Q VLAN ID* about each VLAN on your PT-7710 before the switch can use it to forward traffic:

Managing a VLAN

A new or initialized PT-7710 contains a single VLAN—the Default VLAN. This VLAN has the following definition:

- VLAN Name—Management VLAN
- 802.1Q VLAN ID—1 (if tagging is required)

All the ports are initially placed in this VLAN, and it is the only VLAN that allows you to access the management software of the PT-7710 over the network.

Communication between VLANs

If devices connected to a VLAN need to communicate to devices on a different VLAN, a router or Layer 3 switching device with connections to both VLANs needs to be installed. Communication between VLANs can only take place if they are all connected to a routing or Layer 3 switching device.

VLANs: Tagged and Untagged Membership

The PT-7710 supports 802.1Q VLAN tagging, a system that allows traffic for multiple VLANs to be carried on a single physical (backbone, trunk) link. When setting up VLANs you need to understand when to use untagged and tagged membership of VLANs. Simply put, if a port is on a single VLAN it can be an untagged member, but if the port needs to be a member of multiple VLANs, tagged membership must be defined.

A typical host (e.g., clients) will be untagged members of one VLAN, defined as **Access Port** in the PT-7710, while inter-switch connections will be tagged members of all VLANs, defined as Trunk Port in the PT-7710.

The IEEE Std 802.1Q-1998 defines how VLANs operate within an open packet-switched network. An 802.1Q compliant packet carries additional information that allows a switch to determine which VLAN the port belongs to. If a frame is carrying the additional information, it is known as a *tagged* frame.

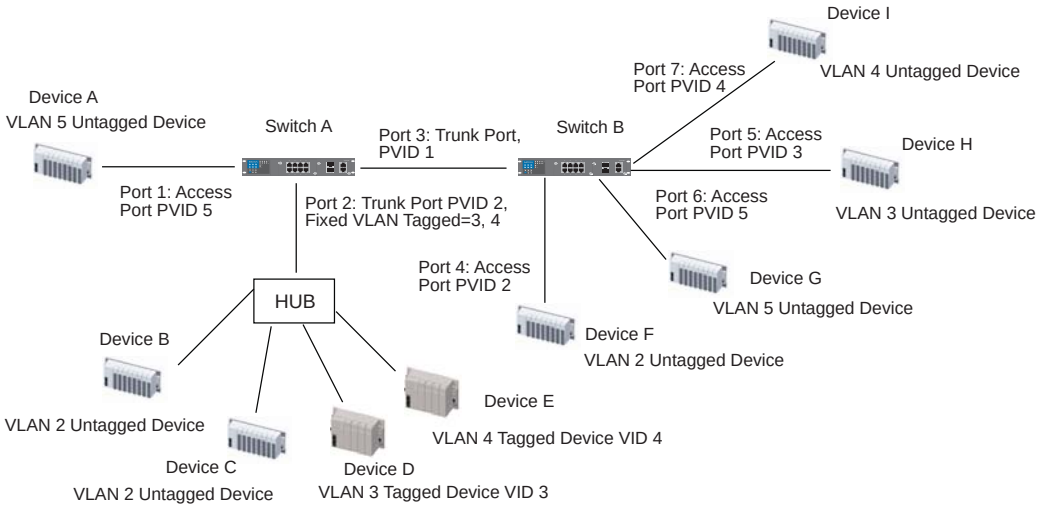
To carry multiple VLANs across a single physical (backbone, trunk) link, each packet must be tagged with a VLAN identifier so that the switches can identify which packets belong in which VLAN. To communicate between VLANs, a router must be used.

The PT-7710 supports two types of VLAN port settings:

- **Access Port:** The port connects to a single device that is not tagged. The user must define the default port PVID that assigns which VLAN the device belongs to. Once the ingress packet of this Access Port egresses to another Trunk Port (the port all packets to carry tag information), PT-7710 will insert this PVID into this packet to help the next 802.1Q VLAN switch recognize it.
- **Trunk Port:** The port connects to a LAN that consists of untagged devices/tagged devices and/or switches and hubs. In general, the traffic of the Trunk Port must have a Tag. Users can also assign PVID to a Trunk Port. The untagged packet on the Trunk Port will be assigned the port default PVID as its VID.

The following section illustrates how to use these ports to set up different applications.

Sample Applications of VLANs using PT-7710



In this application,

- Port 1 connects a single untagged device and assigns it to VLAN 5; it should be configured as Access Port with PVID 5.
- Port 2 connects a LAN with two untagged devices belonging to VLAN 2. One tagged device with VID 3 and one tagged device with VID 4. It should be configured as Trunk Port with PVID 2 for untagged device and Fixed VLAN (Tagged) with 3 and 4 for tagged device. Since each port can only have one unique PVID, all untagged devices on the same port can only belong to the same VLAN.
- Port 3 connects with another switch. It should be configured as Trunk Port GVRP protocol will be used through the Trunk Port.
- Port 4 connects a single untagged device and assigns it to VLAN 2; it should be configured as Access Port with PVID 2.
- Port 5 connects a single untagged device and assigns it to VLAN 3; it should be configured as Access Port with PVID 3.
- Port 6 connect a single untagged device and assigns it to VLAN 5; it should be configured as Access Port with PVID 5.
- Port 7 connects a single untagged device and assigns it to VLAN 4; it should be configured as Access Port with PVID 4.

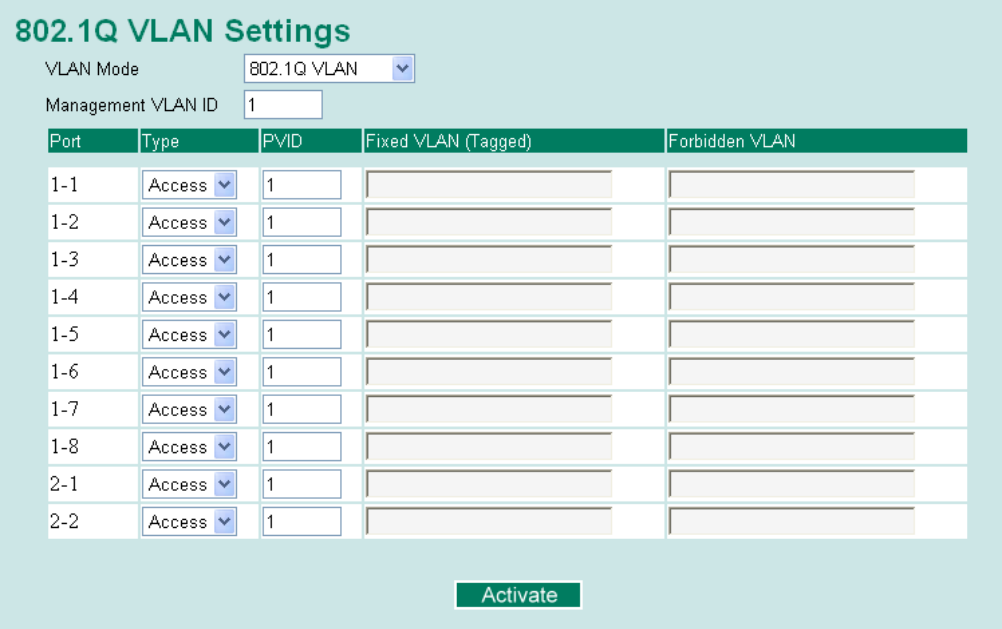
After proper configuration:

- Packets from Device A will travel through Trunk Port 3 with tagged VID 5. Switch B will recognize its VLAN, pass it to port 6, and then remove tags received successfully by Device G, and vice versa.
- Packets from Devices B and C will travel through Trunk Port 3 with tagged VID 2. Switch B recognizes its VLAN, passes it to port 4, and then removes tags received successfully by Device F, and vice versa.
- Packets from Device D will travel through Trunk Port 3 with tagged VID 3. Switch B will recognize its VLAN, pass to port 5, and then remove tags received successfully by Device H. Packets from Device H will travel through Trunk Port 3 with PVID 3. Switch A will recognize its VLAN and pass it to port 2, but will not remove tags received successfully by Device D.
- Packets from Device E will travel through Trunk Port 3 with tagged VID 4. Switch B will recognize its VLAN, pass it to port 7, and then remove tags received successfully by Device I. Packets from Device I will travel through Trunk Port 3 with tagged VID 4. Switch A will recognize its VLAN and pass it to port 2, but will not remove tags received successfully by Device E.

Configuring Virtual LAN

VLAN Settings

To configure **802.1Q VLAN** on the PT-7710, use the VLAN Setting page to configure the ports.



VLAN Mode

Setting	Description	Factory Default
802.1Q VLAN	Set VLAN mode to 802.1Q VLAN	802.1Q VLAN
Port-based VLAN	Set VLAN mode to Port-based VLAN	
802.1Q VLAN (Unaware)	Set VLAN mode to Unaware	

Management VLAN ID

Setting	Description	Factory Default
VLAN ID from 1 to 4094	Assigns the VLAN ID of this PT-7710.	1

Port Type

Setting	Description	Factory Default
Access	This port type is used to connect single devices without tags.	Access
Trunk	Select Trunk port type to connect another 802.1Q VLAN aware switch or another LAN that combines tagged and/or untagged devices and/or other switches/hubs.	

ATTENTION

For communication redundancy in the VLAN environment, set **Redundant Port, Coupling Port** and **Coupling Control Port** as **Trunk Ports** since these ports act as the **backbone** to transmit all packets of different VLANs to different PT-7710 units.

Port PVID

Setting	Description	Factory Default
VID range from 1 to 4094	Sets the default VLAN ID for untagged devices that connect to the port.	1

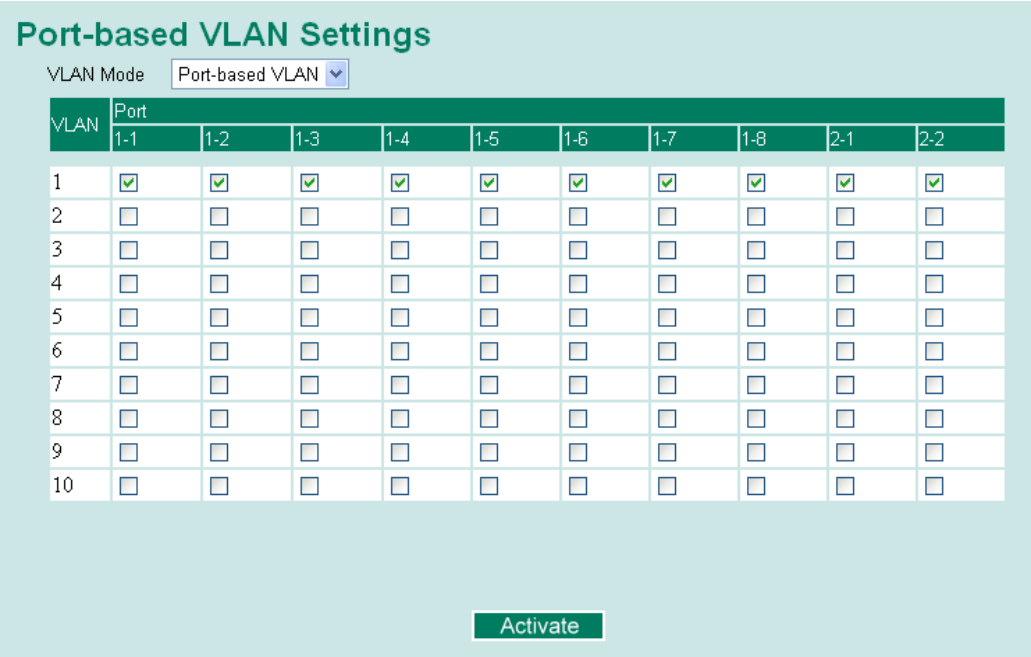
Fixed VLAN List (Tagged)

Setting	Description	Factory Default
VID range from 1 to 4094	This field will be active only when selecting the Trunk port type. Set the other VLAN ID for tagged devices that connect to the Trunk port. Use commas to separate different VIDs.	None

Forbidden VLAN List

Setting	Description	Factory Default
VID range from 1 to 4094	This field will be active only when selecting the Trunk port type. Set the VLAN IDs that will not be supported by this trunk port. Use commas to separate different VIDs.	None

To configure the PT-7710's **port-based VLAN**, use the VLAN settings page to configure the ports.



VLAN Mode

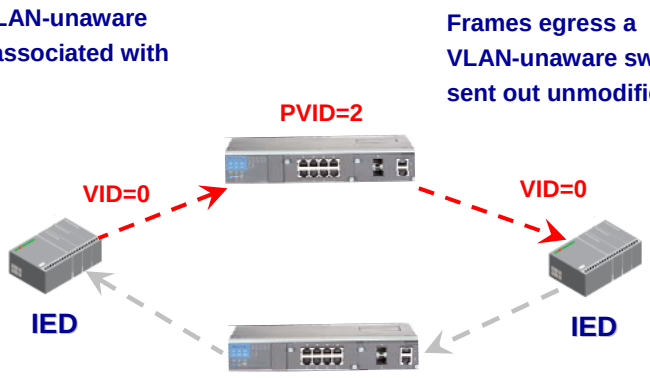
Setting	Description	Factory Default
802.1Q VLAN	Sets VLAN mode to 802.1Q VLAN	802.1Q VLAN
Port-based VLAN	Sets VLAN mode to Port-based VLAN	
802.1Q VLAN (Unaware)	Sets VLAN mode to Unaware	

Port

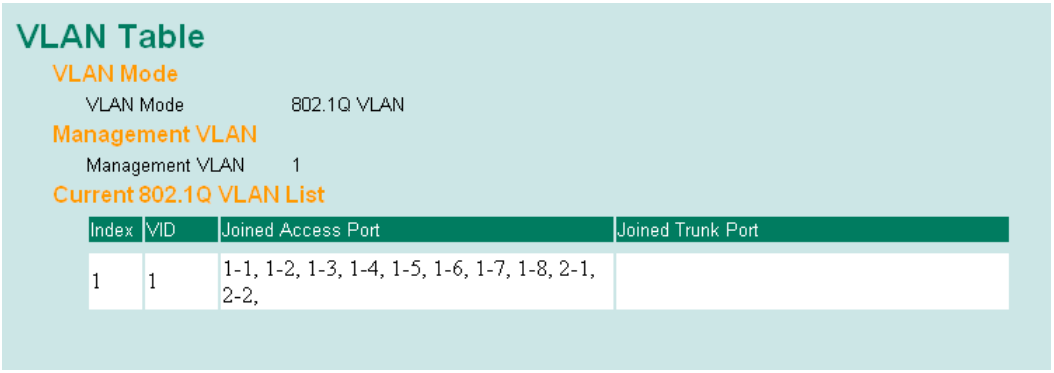
Setting	Description	Factory Default
Enable/Disable	Set port to specific VLAN Group.	Enable (all ports belong to VLAN1)

Use the VLAN settings page to configure the PT-7710's **VLAN Unaware mode**

For certain power substation scenarios, some applications may require priority-tagged frames to be received by IEDs. To fulfill these requirements, Moxa's PT-7710 series Ethernet switches support the VLAN Unaware function.



VLAN Table


VLAN Table
VLAN Mode
VLAN Mode 802.1Q VLAN
Management VLAN
Management VLAN 1
Current 802.1Q VLAN List
Index VID Joined Access Port Joined Trunk Port
1 1 1-1, 1-2, 1-3, 1-4, 1-5, 1-6, 1-7, 1-8, 2-1, 2-2,

In 802.1Q VLAN table, you can review the VLAN groups that were created, Joined Access Ports, and Trunk Ports, and in Port-based VLAN table, you can review the VLAN group and Joined port.

NOTE The physical network can have a maximum of 64 VLAN settings.

Using Multicast Filtering

Multicast filtering improves the performance of networks that carry multicast traffic. This section explains multicasts, multicast filtering, and how multicast filtering can be implemented on your PT-7710.

The Multicast Filtering Concept

What is an IP Multicast?

A *multicast* is a packet sent by one host to multiple hosts. Only those hosts that belong to a specific multicast group will receive the multicast. If the network is set up correctly, a multicast can only be sent to an end-station or a subset of end-stations on a LAN or VLAN that belong to the multicast group. Multicast group members can be distributed across multiple subnets, so that multicast transmissions can occur within a campus LAN or over a WAN. In addition, networks that support IP multicast send only *one* copy of the desired information across the network until the delivery path that reaches group members diverges. To make more efficient use of network bandwidth, it is only at these points that multicast packets are duplicated and forwarded. A multicast packet has a multicast group address in the destination address field of the packet's IP header.

Benefits of Multicast

The benefits of using IP multicast are that it:

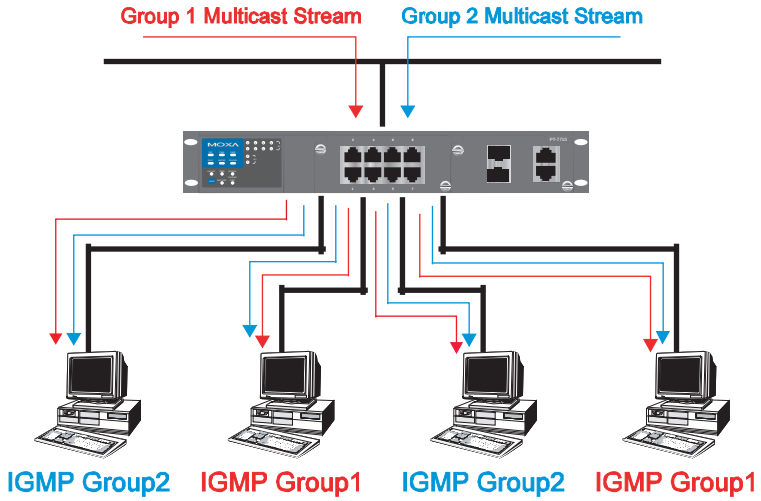
- Uses the most efficient, sensible method to deliver the same information to many receivers with only one transmission.
- Reduces the load on the source (for example, a server) since it will not need to produce several copies of the same data.
- Makes efficient use of network bandwidth and scales well as the number of multicast group members increases.
- Works with other IP protocols and services, such as Quality of Service (QoS).

Multicast transmission makes more sense and is more efficient than unicast transmission for some applications. For example, multicasts are often used for video-conferencing, since high volumes of traffic must be sent to several end-stations at the same time, but where broadcasting the traffic to all end-stations would cause a substantial reduction in network performance. Furthermore, several industrial automation protocols, such as Allen-Bradley, EtherNet/IP, Siemens Profibus, and Foundation Fieldbus HSE (High Speed Ethernet), use multicast. These industrial Ethernet protocols use publisher/subscriber communications models by multicasting packets that could flood a network with heavy traffic. IGMP Snooping is used to prune multicast traffic so that it travels only to those end destinations that require the traffic, reducing the amount of traffic on the Ethernet LAN.

Multicast Filtering

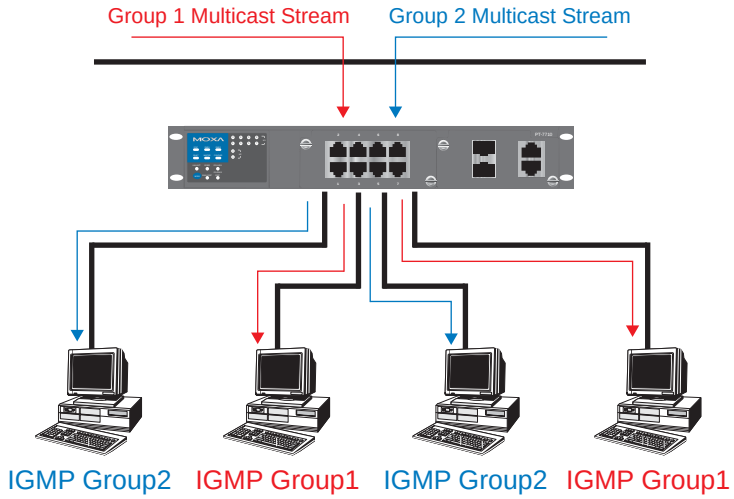
Multicast filtering ensures that only end-stations that have joined certain groups receive multicast traffic. With multicast filtering, network devices only forward multicast traffic to the ports that are connected to registered end-stations. The following two figures illustrate how a network behaves without multicast filtering, and with multicast filtering.

Network without multicast filtering



All hosts receive the multicast traffic, even if they don't need it.

Network with multicast filtering



Hosts only receive dedicated traffic from other hosts belonging to the same group.

Multicast Filtering and Moxa PowerTrans Switch

The PT-7710 has three ways to achieve multicast filtering: IGMP (Internet Group Management Protocol) Snooping, GMRP (GARP Multicast Registration Protocol), and adding a static multicast MAC manually to filter multicast traffic automatically.

IGMP (Internet Group Management Protocol)

Snooping Mode

Snooping Mode allows your switch to forward multicast packets only to the appropriate ports. The switch **snoops** on exchanges between hosts and an IGMP device, such as a router, to find those ports that want to join a multicast group, and then configures its filters accordingly.

IGMP Snooping Enhanced Mode

Snooping Enhanced Mode allows your switch to forward multicast packets to the PT-7710's member port only. If you disable Enhanced Mode, data streams will run to the querier port as well as the member port.

Query Mode

Query mode allows the PT-7710 to work as the querier if it has the lowest IP address on the subnetwork to which it belongs. IGMP querying is enabled by default on the PT-7710 to help prevent interoperability issues with some multicast routers that may not follow the lowest IP address election method. Enable query mode to run multicast sessions on a network that does not contain IGMP routers (or queriers).

NOTE PT-7710 is compatible with any device that conforms to the IGMP v2 and IGMP v3 device protocol.

IGMP Multicast Filtering

IGMP is used by IP-supporting network devices to register hosts with multicast groups. It can be used on all LANs and VLANs that contain a multicast capable IP router, and on other network devices that support multicast filtering. IGMP works as follows:

1. The IP router (or querier) periodically sends query packets to all end-stations on the LANs or VLANs that are connected to it. For networks with more than one IP router, the router with the lowest IP address is the querier. A switch with IP address lower than the IP address of any other IGMP queriers connected to the LAN or VLAN can become the IGMP querier.
2. When an IP host receives a query packet, it sends a report packet back that identifies the multicast group that the end-station would like to join.

3. When the report packet arrives at a port on a switch with IGMP Snooping enabled, the switch knows that the port should forward traffic for the multicast group, and then proceeds to forward the packet to the router.
4. When the router receives the report packet, it registers that the LAN or VLAN requires traffic for the multicast groups.
5. When the router forwards traffic for the multicast group to the LAN or VLAN, the switches only forward the traffic to ports that received a report packet.

GMRP (GARP Multicast Registration Protocol)

The PT-7710 supports IEEE 802.1D-1998 GMRP (GARP Multicast Registration Protocol), which differs from IGMP (Internet Group Management Protocol). GMRP is a MAC-based multicast management protocol, whereas IGMP is IP-based. GMRP provides a mechanism that allows bridges and end stations to register or de-register Group membership information dynamically. GMRP functions similarly to GVRP, except that GMRP registers multicast addresses on ports. When a port receives a ***GMRP-join*** message, it will register the multicast address to its database if the multicast address is not registered, and all the multicast packets with that multicast address are able to be forwarded from this port. When a port receives a ***GMRP-leave*** message, it will de-register the multicast address from its database, and all the multicast packets with this multicast address are not able to be forwarded from this port.

Static Multicast MAC

Some devices may only support multicast packets, but not support either IGMP Snooping or GMRP. The PT-7710 supports adding multicast groups manually to enable multicast filtering.

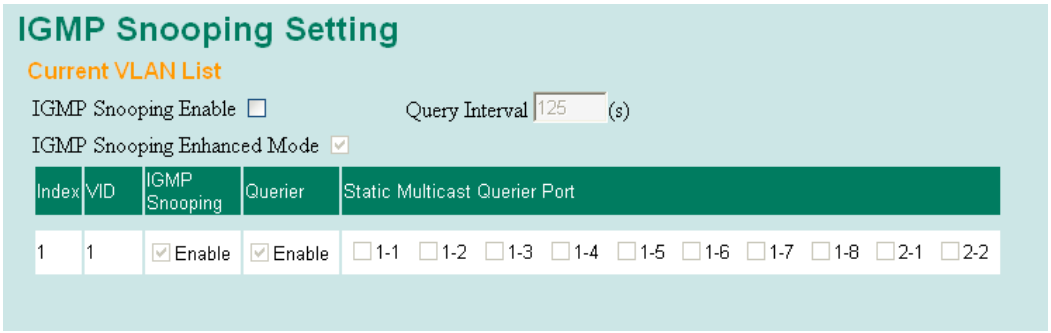
Enabling Multicast Filtering

Use the serial console or Web interface to enable or disable IGMP Snooping and IGMP querying. If IGMP Snooping is not enabled, then IP multicast traffic is always forwarded, flooding the network.

Configuring IGMP Snooping

IGMP Snooping provides the ability to prune multicast traffic so that it travels only to those end destinations that require that traffic, thereby reducing the amount of traffic on the Ethernet LAN.

IGMP Snooping Settings


IGMP Snooping Setting
Current VLAN List
IGMP Snooping Enable
Query Interval 125 (s)
IGMP Snooping Enhanced Mode
Index VID IGMP Snooping Querier Static Multicast Querier Port
1 1 Enable Enable 1-1 1-2 1-3 1-4 1-5 1-6 1-7 1-8 2-1 2-2

IGMP Snooping Enable

Setting	Description	Factory Default
Enable/Disable	Click the checkbox to enable the IGMP Snooping function globally.	Disabled

IGMP Snooping Enhanced Mode

Setting	Description	Factory Default
Enable	IGMP Multicast packets will be forwarded to: Auto-Learned Multicast Querier Ports Member Ports	Enable
Disable	IGMP Multicast packets will be forwarded to: Auto-Learned Multicast Querier Ports Static Multicast Querier Ports Querier Connected Ports Member Ports	

Query Interval

Setting	Description	Factory Default
Numerical value input by user	Sets the query interval of the Querier function globally. Valid settings are from 20 to 600 seconds.	125 seconds

IGMP Snooping

Setting	Description	Factory Default
Enable/Disable	Enables or disables the IGMP Snooping function per VLAN.	Enabled if IGMP Snooping Enabled Globally

Querier

Setting	Description	Factory Default
Enable/Disable	Enables or disables the PT-7710's querier function.	Enabled if IGMP Snooping is Enabled Globally

Static Multicast Querier Port

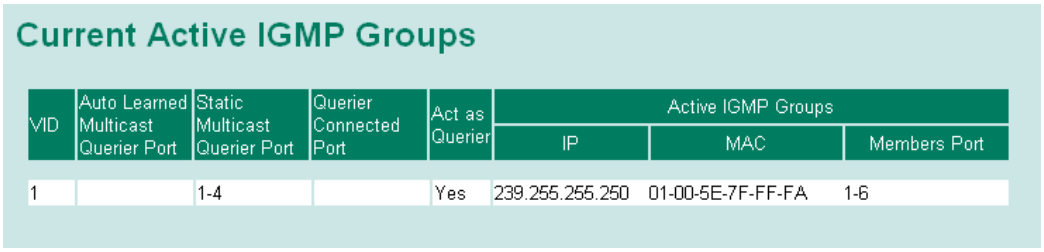
Setting	Description	Factory Default
Select/Deselect	Selects the ports that will connect to the multicast routers. It is active only when IGMP Snooping is enabled.	Disabled

NOTE If a router or layer 3 switches is connected to the network, it will act as the Querier; thus, this Querier option will be disabled on all Moxa layer 2 switches.

If all switches on the network are Moxa layer 2 switches, then only one layer 2 switch will act as Querier.

IGMP Table

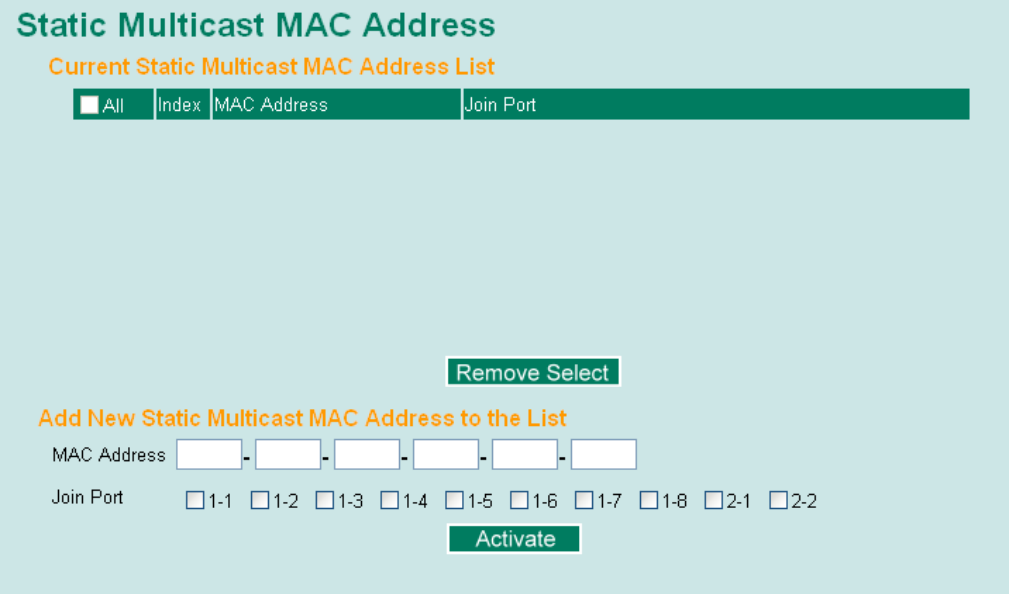
The PT-7710 displays the current active IGMP groups that were detected.



The information includes **VID**, **Auto-learned Multicast Querier Port**, **Static Multicast Querier Port**, **Querier Connected Port**, and the **IP** and **MAC** addresses of active IGMP groups.

Add Static Multicast MAC

If required, the PT-7710 also supports adding multicast groups manually.



Add New Static Multicast Address to the List

Setting	Description	Factory Default
MAC Address	Input the multicast MAC address of this host.	None

MAC Address

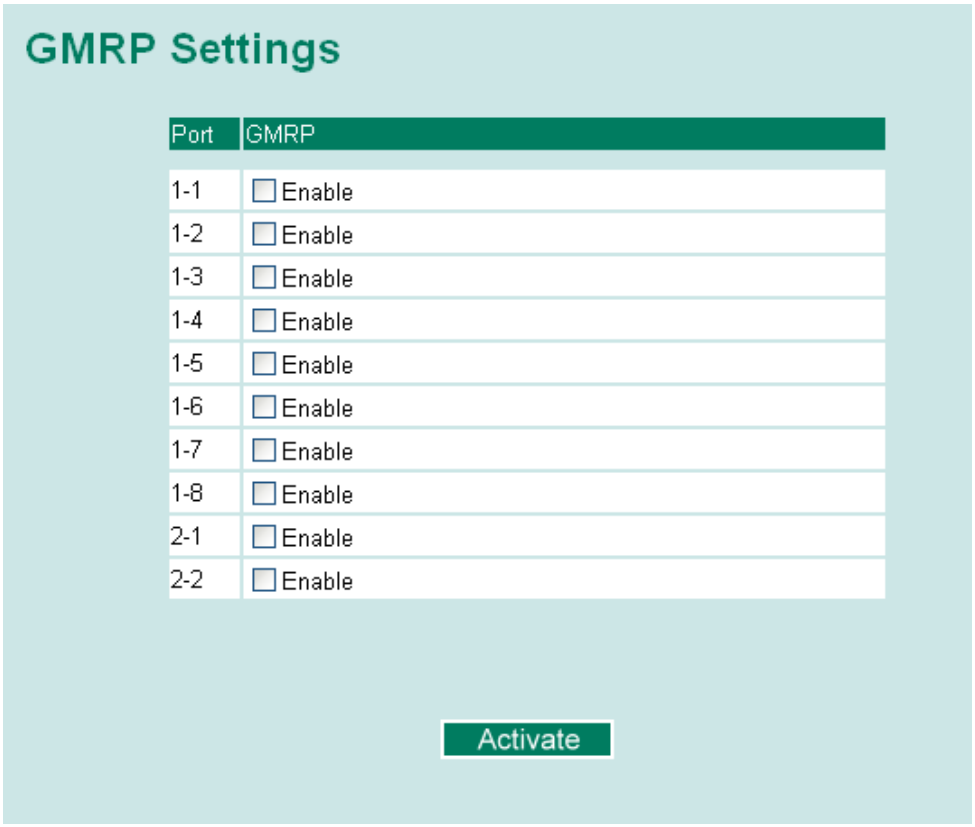
Setting	Description	Factory Default
Integer	Input the number of the VLAN that the host with this MAC address belongs to.	None

Join Port

Setting	Description	Factory Default
Select/Deselect	Checkmark the appropriate check boxes to select the join ports for this multicast group.	None

Configuring GMRP

GMRP is a MAC-based multicast management protocol, whereas IGMP is IP-based. GMRP provides a mechanism that allows bridges and end stations to register or un-register Group membership information dynamically.

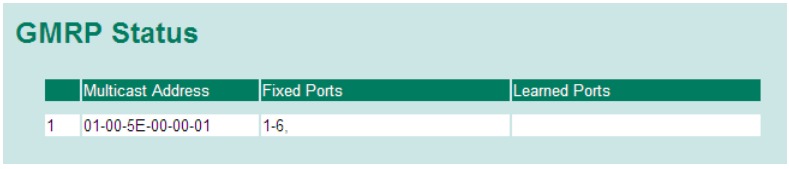


GMRP enable

Setting	Description	Factory Default
Enable/Disable	Enables or disables the GMRP function for the port listed in the Port column	Disable

GMRP Table

The PT-7710 displays the current active GMRP groups that were detected

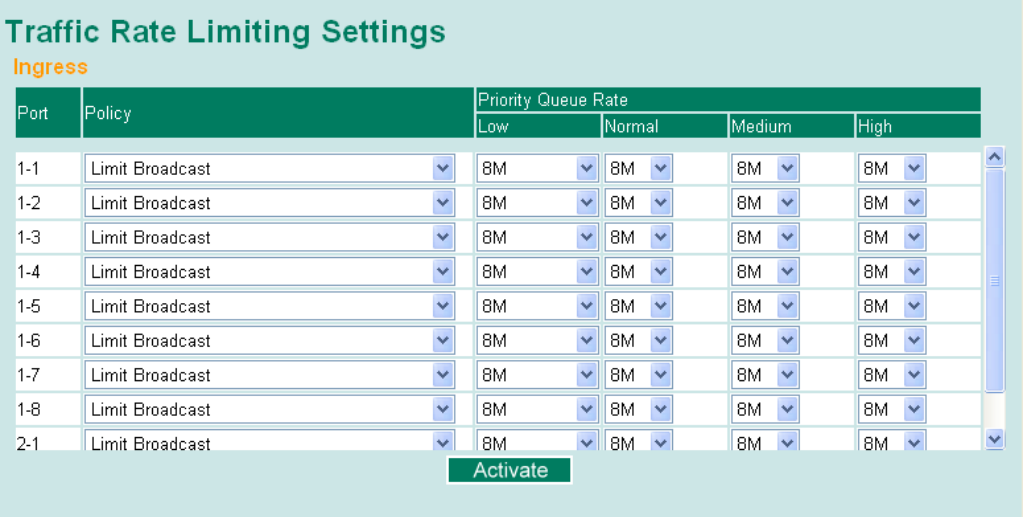


Setting	Description
Fixed Ports	This multicast address is defined by static multicast.
Learned Ports	This multicast address is learned by GMRP.

Using Bandwidth Management

In general, one host should not be allowed to occupy unlimited bandwidth, particularly when the device malfunctions. The PT-7710 can be configured to a different ingress rate for all packets, giving administrators full control of their limited bandwidth to prevent undesirable effects caused by unpredictable faults.

Traffic Rate Limiting Settings


Traffic Rate Limiting Settings
Ingress
Port
Policy
Priority Queue Rate
Low
Normal
Medium
High
1-1 Limit Broadcast 8M 8M 8M 8M
1-2 Limit Broadcast 8M 8M 8M 8M
1-3 Limit Broadcast 8M 8M 8M 8M
1-4 Limit Broadcast 8M 8M 8M 8M
1-5 Limit Broadcast 8M 8M 8M 8M
1-6 Limit Broadcast 8M 8M 8M 8M
1-7 Limit Broadcast 8M 8M 8M 8M
1-8 Limit Broadcast 8M 8M 8M 8M
2-1 Limit Broadcast 8M 8M 8M 8M
Activate

Ingress

Setting	Description	Factory Default
Ingress rate	Select the ingress rate for all packets from the following options: not limited, 128K, 256K, 512K, 1M, 2M, 4M, 8M	N/A

Using Port Access Control

The PT-7710 provides two kinds of Port-Base Access Control. One is Static Port Lock and the other is IEEE 802.1X.

Static Port Lock

The PT-7710 can also be configured to protect static MAC addresses for a specific port. With the Port Lock function, these locked ports will not learn any additional addresses, but only allow traffic from preset static MAC addresses, helping to block hackers and careless usage.

IEEE 802.1X

The IEEE 802.1X standard defines a protocol for client/server-based access control and authentication. The protocol restricts unauthorized clients from connecting to a LAN through ports that are open to the Internet, and which otherwise would be readily accessible. The purpose of the authentication server is to check each client that requests access to the port. The client is only allowed access to the port if the client's permission is authenticated.

The IEEE 802.1X Protocol

Three components are used to create an authentication mechanism based on 802.1X standards: Client/Supplicant, Authentication Server, and Authenticator.

Supplicant: The end station that requests access to the LAN and switch services and responds to the requests from the switch.

Authentication server: The server that performs the actual authentication of the supplicant.

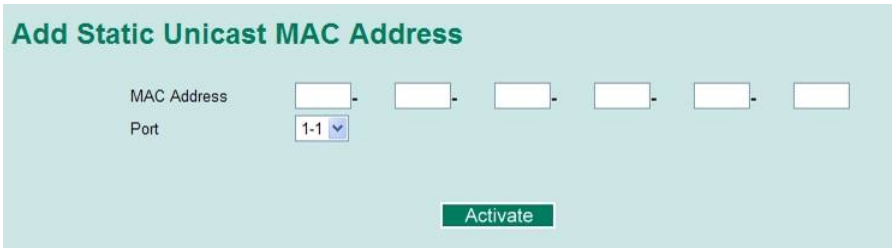
Authenticator: Edge switch or wireless access point that acts as a proxy between the supplicant and the authentication server, requesting identity information from the supplicant, verifying the information with the authentication server, and relaying a response to the supplicant.

The PT-7710 acts as an authenticator in the 802.1X environment. A supplicant and an authenticator exchange EAPOL (Extensible Authentication Protocol over LAN) frames with each other. We can either use an external RADIUS server as the authentication server, or implement the authentication server in PT-7710 by using a Local User Database as the authentication look-up table. When we use an external RADIUS server as the authentication server, the authenticator and the authentication server exchange EAP frames between each other.

Authentication can be initiated either by the supplicant or the authenticator. When the supplicant initiates the authentication process, it sends an **EAPOL-Start** frame to the authenticator. When the authenticator initiates the authentication process or when it receives an **EAPOL Start** frame, it sends an **EAP Request / Identity** frame to ask for the username of the supplicant.

Configuring Static Port Lock

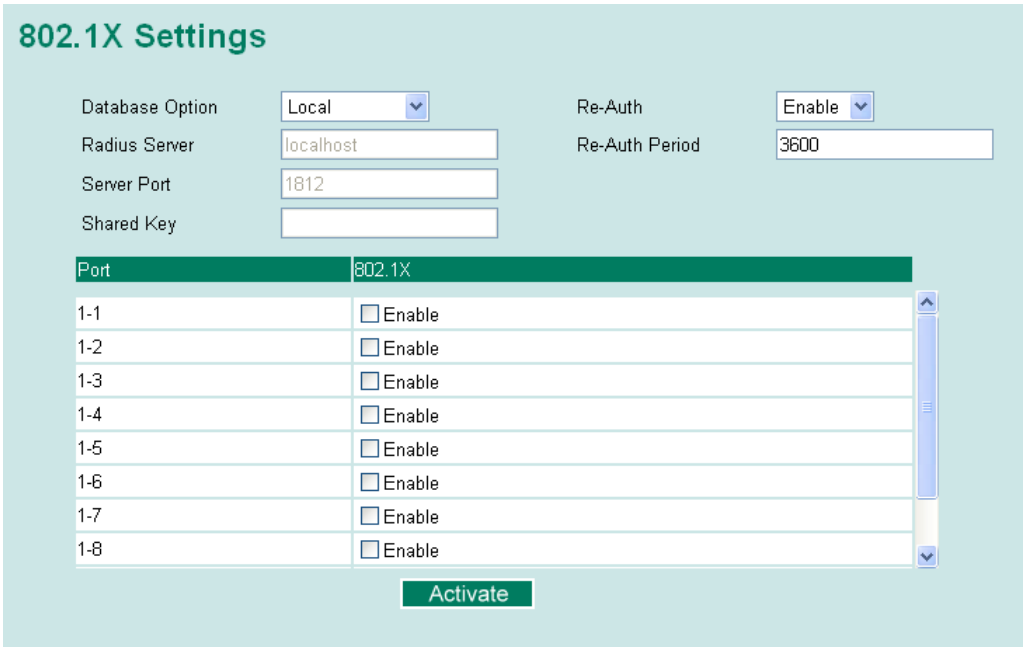
The PT-7710 supports adding unicast groups manually if required.



MAC Address and Port

Setting	Description	Factory Default
MAC Address	Add the static unicast MAC address into the address table.	None
Port	Fix the static address with a dedicated port.	1-1

Configuring IEEE 802.1X



Database Option

Setting	Description	Factory Default
Local (Max. 32 users)	Select this option when setting the Local User Database as the authentication database.	Local
Radius	Select this option to set an external RADIUS server as the authentication database. The authentication mechanism is EAP-MD5.	Local
Radius, Local	Select this option to make using an external RADIUS server as the authentication database the second priority. The authentication mechanism is EAP-MD5 The first priority is to set the Local User Database as the authentication database.	Local

Radius Server

Setting	Description	Factory Default
IP address or domain name	The IP address or domain name of the RADIUS server.	local host

Server Port

Setting	Description	Factory Default
Numerical	The UDP port of the RADIUS server.	1812

Shared Key

Setting	Description	Factory Default
alphanumeric (Max. 40 characters)	A key to be shared between the external RADIUS server and PT-7710. Both ends must be configured to use the same key.	None

Re-Auth

Setting	Description	Factory Default
Enable/Disable	Select to require re-authentication of the client after a preset time period of inactivity has elapsed.	Disable

Re-Auth Period

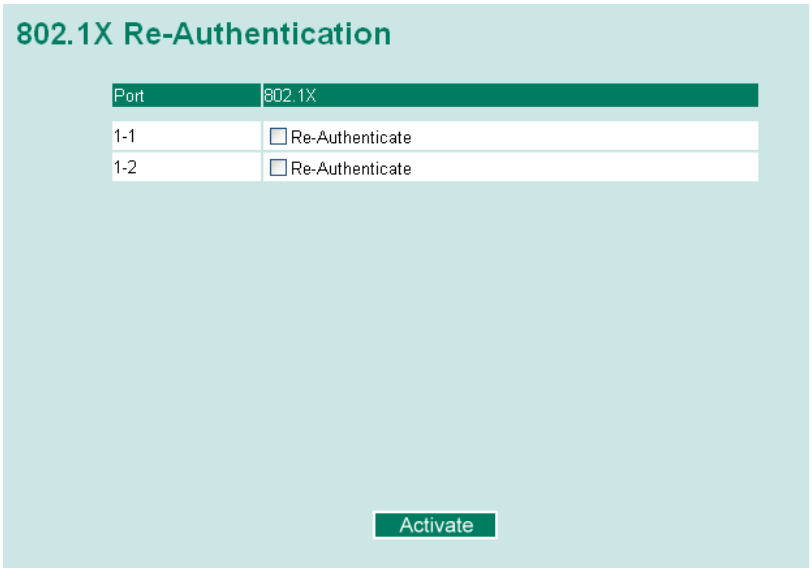
Setting	Description	Factory Default
Numerical (60 to 65535 sec.)	Specify how frequently the end stations need to reenter usernames and passwords in order to stay connected.	3600

802.1X

Setting	Description	Factory Default
Enable/Disable	Click the checkbox under the 802.1X column to enable IEEE 802.1X for one or more ports. All end stations must enter usernames and passwords before access to these ports is allowed.	Disable

802.1X Re-Authentication

The PT-7710 can force connected devices to be re-authorized manually.

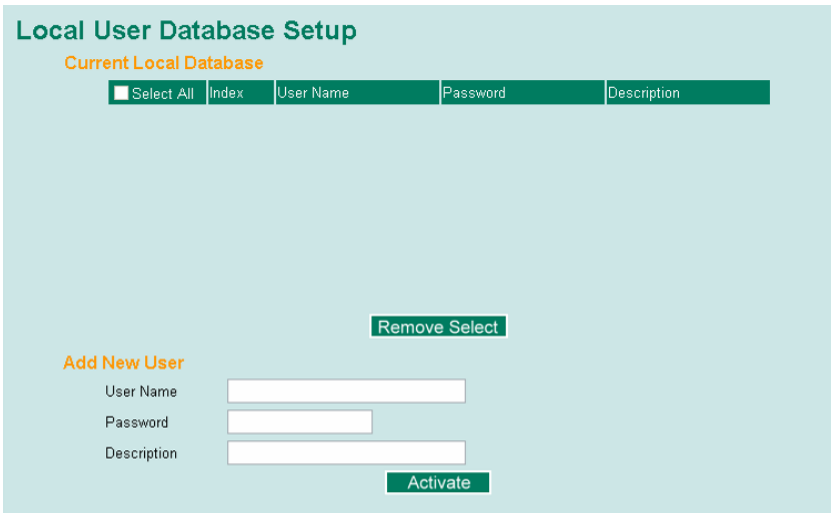


802.1X Re-Authentication

Setting	Description	Factory Default
Enable/Disable	Enables or disables 802.1X Re-Authentication	Disable

Local User Database Setup

When setting the **Local User Database** as the authentication database, set the database first.



Local User Database Setup

Setting	Description	Factory Default
User Name (Max. 30 characters)	User Name for Local User Database	None
Password (Max. 16 characters)	Password for Local User Database	None
Description (Max. 30 characters)	Description for Local User Database	None

NOTE The user name for the Local User Database is case-insensitive.

Port Access Control Table

The port status will show authorized or unauthorized.

Using Auto Warning

Since industrial Ethernet devices are often located at the endpoints of a system, these devices will not always know what is happening elsewhere on the network. This means that an industrial Ethernet switch that connects to these devices must provide system maintainers with real-time alarm messages. Even when control engineers are out of the control room for an extended period of time, they can still be informed of the status of devices almost instantaneously when exceptions occur. The PT-7710 supports multiple warning methods, such as email and relay output. It also supports two digital inputs to integrate sensors into your system to automate alarms by email and relay output.

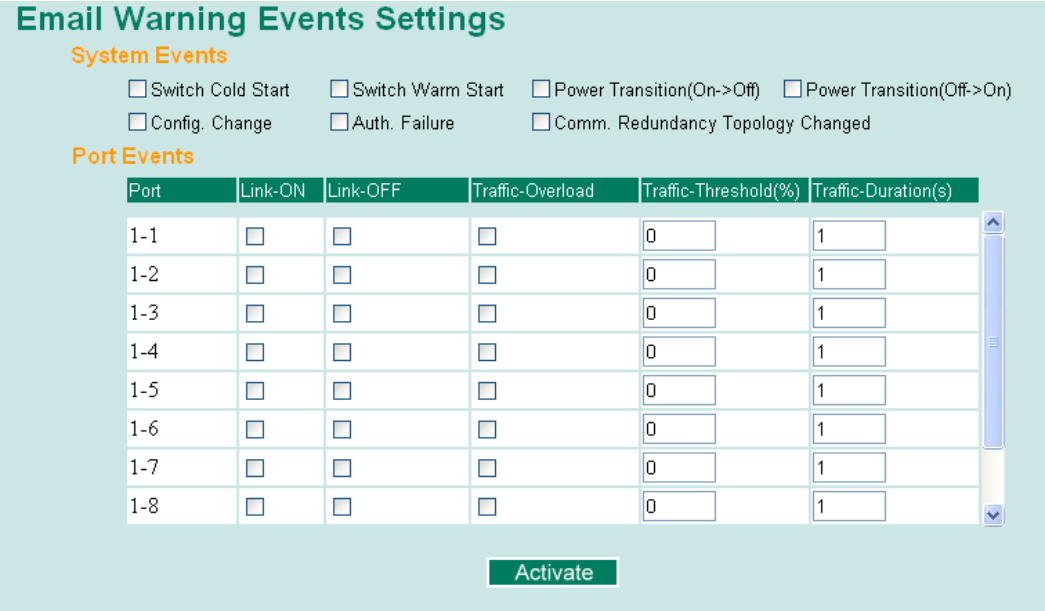
Configuring Email Warnings

The Auto Email Warning function uses e-mail to alert the user when certain user-configured events take place.

Three basic steps are required to set up the Auto Warning function:

1. **Configuring Email Event Types**
   Select the desired **Event types** from the Console or Web Browser Event type page (a description of each event type is given later in the *Email Warning Events Settings subsection*).
2. **Configuring Email Settings**
   To configure PT-7710's email setup from the serial, Telnet, or web console, enter your Mail Server IP/Name (IP address or name), Account Name, Account Password, Retype New Password, and the email address to which warning messages will be sent.
3. **Activate your settings and if necessary, test the email**
   After configuring and activating your PT-7710's Event Types and Email Setup, you can use the **Test Email** function to see if your e-mail addresses and mail server address have been properly configured.

Event Type



Event Types can be divided into two basic groups: **System Events** and **Port Events**. System Events are related to the overall function of the switch, whereas Port Events are related to the activity of a specific port.

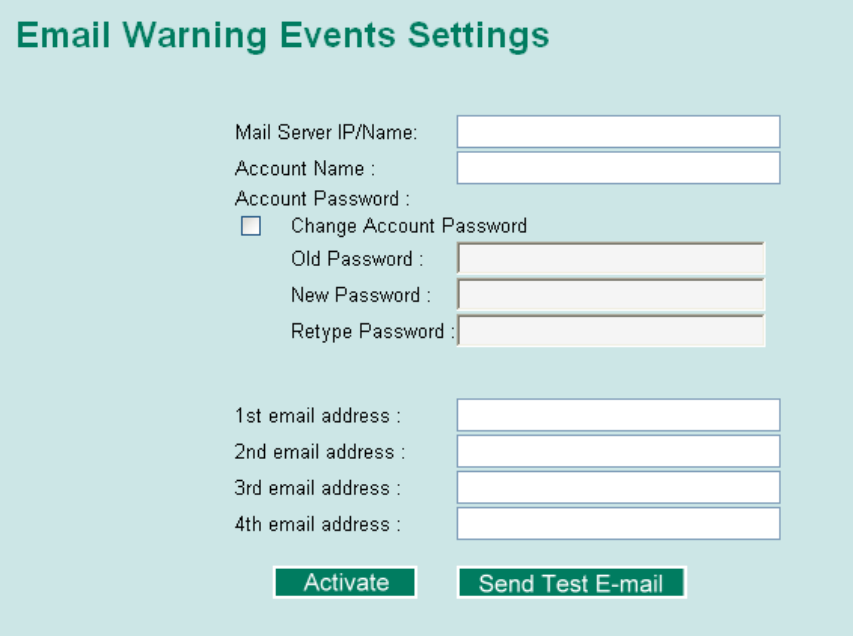
System Events	Warning e-mail is sent when…
Switch Cold Start	Power is cut off and then reconnected.
Switch Warm Start	The PT-7710 is rebooted, such as when network parameters are changed (IP address, subnet mask, etc.).
Power Transition (On→Off)	The PT-7710 is powered down.
Power Transition (Off→On)	The PT-7710 is powered up.
Configuration Change Activated	Any configuration item has been changed.
Authentication Failure	An incorrect password is entered.
Comm. Redundancy Topology Changed	If any Spanning Tree Protocol switches have changed their position (applies only to the root of the tree). If the Master of the Turbo Ring has changed or the backup path is activated.

Port Events	Warning e-mail is sent when…
Link-ON	The port is connected to another device.
Link-OFF	The port is disconnected (e.g., the cable is pulled out, or the opposing device shuts down).
Traffic-Overload	The port's traffic surpasses the Traffic-Threshold for that port (provided this item is Enabled).
Traffic-Threshold (%)	Enter a nonzero number if the port's Traffic-Overload item is Enabled.
Traffic-Duration (sec.)	A Traffic-Overload warning is sent every Traffic-Duration seconds if the average Traffic-Threshold is surpassed during that time period.

NOTE The Traffic-Overload, Traffic-Threshold (%), and Traffic-Duration (sec.) Port Event items are related. If you Enable the Traffic-Overload event, then be sure to enter a nonzero Traffic-Threshold percentage, as well as a Traffic-Duration between 1 and 300 seconds.

NOTE Warning e-mail messages will have sender given in the form:
Moxa_PowerTrans_Switch_00001@Switch_Location
where Moxa_PowerTrans_Switch is the default Switch Name, 00001 is PT-7710's serial number, and Switch_Location is the default Server Location.
Refer to the Basic Settings section to see how to modify Switch Name and Switch Location.

Email Setup



Mail Server IP/Name

Setting	Description	Factory Default
IP address	The IP Address of your email server.	None

Account Name

Setting	Description	Factory Default
Max. 45 Charters	Your email account.	None

Password Setting

Setting	Description	Factory Default
Disable/Enable to change password	To reset the password from the Web Browser interface, click the Change password check-box, type the Old password, type the New password, retype the New password, and then click Activate; Max. 45 characters.	Disable
Old password	Type the current password when changing the password	None
New password	Type new password when enabled to change password; Max. 45 characters.	None
Retype password	If you type a new password in the Password field, you will be required to retype the password in the Retype new password field before updating the new password.	None

Email Address

Setting	Description	Factory Default
Max. 30 characters	You can set up to 4 email addresses to receive alarm emails from PT-7710.	None

Send Test Email

After finishing with the email settings, you should first click **Activate** to activate those settings, and then press the **Send Test Email** button to verify that the settings are correct.

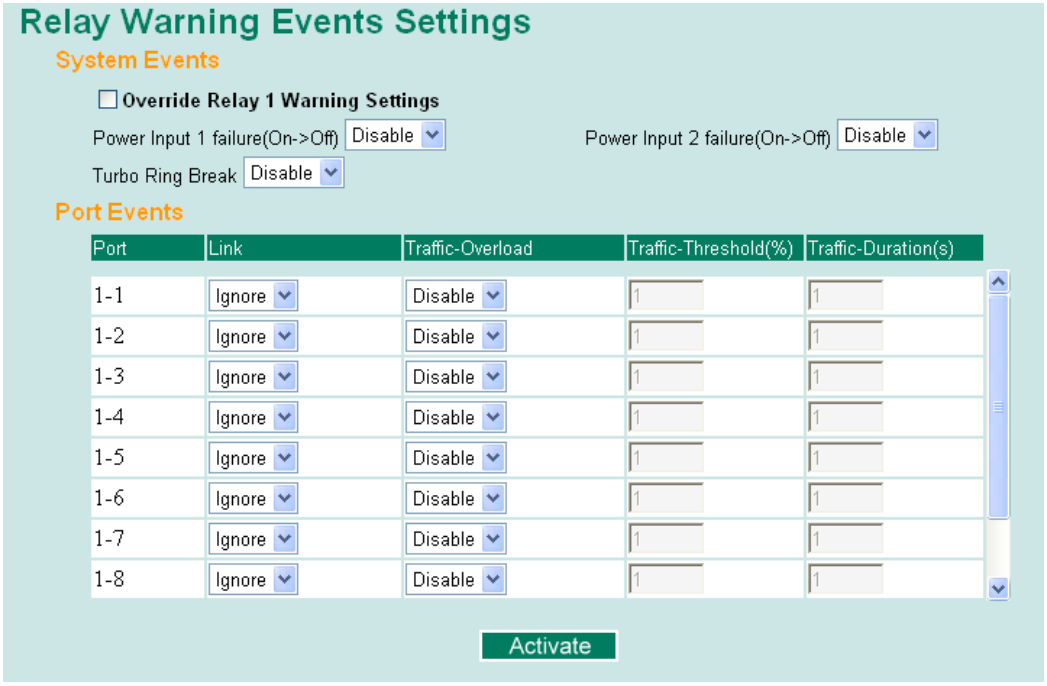
NOTE Auto warning e-mail messages will be sent through an authentication protected SMTP server that supports the CRAM-MD5, LOGIN, and PAIN methods of SASL (Simple Authentication and Security Layer) authentication mechanism.
We strongly recommend not entering your Account Name and Account Password if auto warning e-mail messages can be delivered without using an authentication mechanism.

Configuring Relay Warning

The Auto Relay Warning function uses relay output to alert the user when certain user-configured events take place. There are two basic steps required to set up the Relay Warning function:

1. **Configuring Relay Event Types**
   Select the desired **Event types** from the Console or Web Browser Event type page (a description of each event type is given later in the *Relay Alarm Events setting* subsection).
2. **Activate your settings**
   After completing the configuration procedure, you will need to activate your PT-7710's Relay Event Types.

Event Setup



Event Types can be divided into two basic groups: **System Events** and **Port Events**. System Events are related to the overall function of the switch, whereas Port Events are related to the activity of a specific port.

The PT-7710 supports two relay outputs. You can configure which relay output is related to which events. This helps administrators identify the importance of the different events.

System Events	Warning Relay output is triggered when…
Power Transition (On→Off)	The PT-7710 is powered on.
Power Transition (Off→On)	The PT-7710 is powered down.

NOTE The Traffic-Overload, Traffic-Threshold (%), and Traffic-Duration (sec) Port Event items are related. If you Enable the Traffic-Overload event, then be sure to enter a nonzero Traffic-Threshold percentage, as well as a Traffic-Duration between 1 and 300 seconds.

Override relay alarm settings

Click the checkbox to override the relay warning setting temporarily. Releasing the relay output will allow administrators to fix any problems with the warning condition.

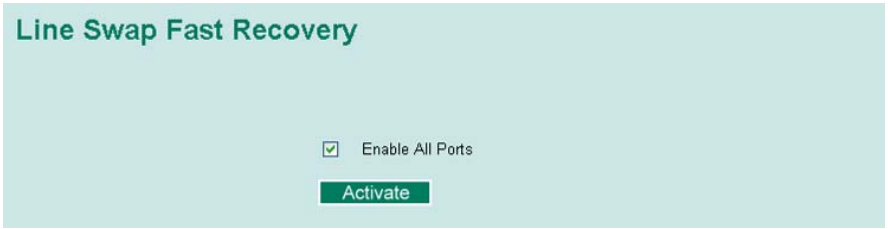
Warning List

Use this table to see if any relay alarms have been issued.

Using Line-Swap-Fast-Recovery

The Line-Swap Fast Recovery function, which is enabled by default, allows PT-7710 to return to normal operation extremely quickly after devices are unplugged and then re-plugged into different ports. The recovery time is on the order of a few milliseconds (compare this with standard commercial switches for which the recovery time could be on the order of several minutes). To disable the Line-Swap Fast Recovery function, or to re-enable the function after it has already been disabled, access either the Console utility's **Line-Swap recovery** page, or the Web Browser interface's **Line-Swap fast recovery** page, as shown below.

Configuring Line-Swap Fast Recovery



Enable Line-Swap-Fast-Recovery

Setting	Description	Factory Default
Enable/Disable	Check-mark the check box to enable the Line-Swap-Fast-Recovery function	Enable

Using Set Device IP

To reduce the effort required to set up IP addresses, the PT-7710 comes equipped with DHCP/BootP server and RARP protocol to set up IP addresses of Ethernet-enabled devices automatically.

When enabled, the **Set device IP** function allows PT-7710 to assign specific IP addresses automatically to connected devices that are equipped with *DHCP Client* or *RARP* protocol. In effect, PT-7710 acts as a DHCP

server by assigning a connected device with a specific IP address stored in its internal memory. Each time the connected device is switched on or rebooted, PT-7710 sends the device the desired IP address.

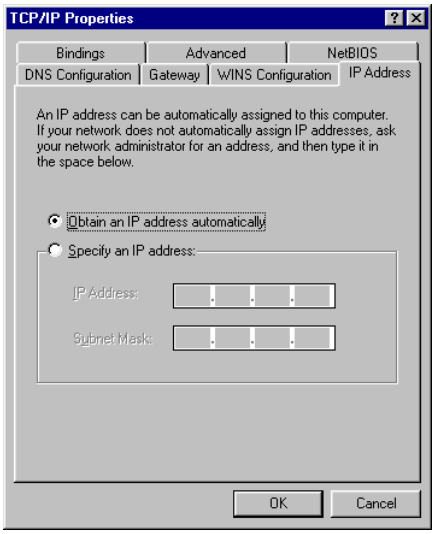
Take the following steps to use the **Set device IP** function:

STEP 1—Set up the connected devices

Set up those Ethernet-enabled devices connected to PT-7710 for which you would like IP addresses to be assigned automatically. The devices must be configured to obtain their IP address automatically.

The devices' configuration utility should include a setup page that allows you to choose an option similar to Obtain an IP address automatically.

For example, Windows' TCP/IP Properties window is shown at the right. Although your device's configuration utility may look quite a bit different, this figure should give you some idea of what to look for.


TCP/IP Properties
Bindings
Advanced
NetBIOS
DNS Configuration
Gateway
WINS Configuration
IP Address
An IP address can be automatically assigned to this computer. If your network does not automatically assign IP addresses, ask your network administrator for an address, and then type it in the space below.
Obtain an IP address automatically
Specify an IP address:
IP Address:
Subnet Mask:
OK
Cancel

You also need to decide which of PT-7710's ports your Ethernet-enabled devices will be connected to. You will need to set up each of these ports separately, as described in the following step.

STEP 2

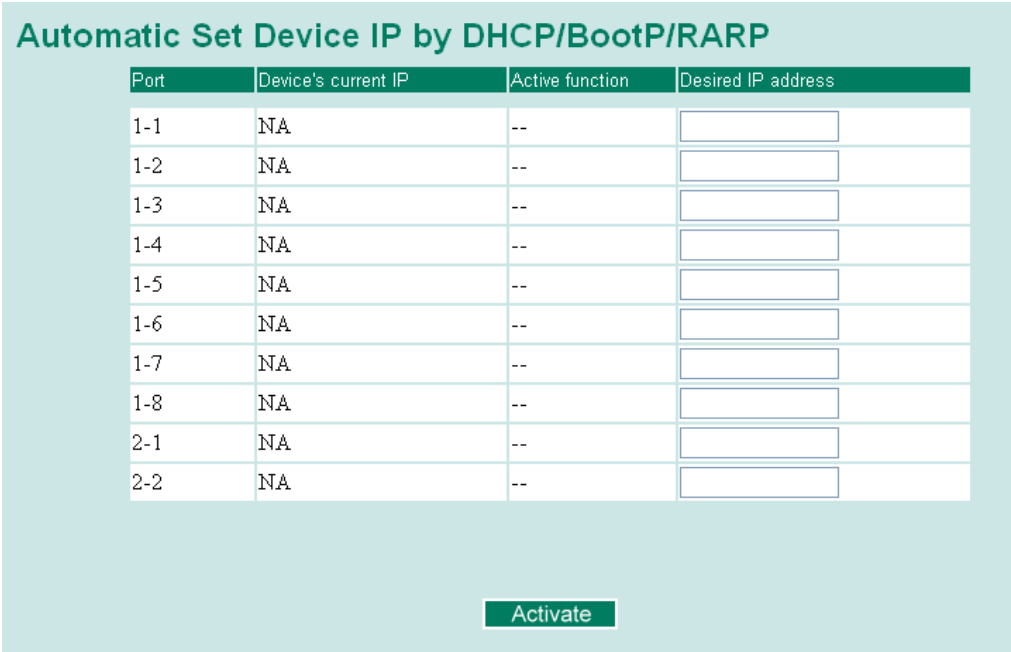
Configure PT-7710's **Set device IP** function, either from the Console utility or from the Web Browser interface. In either case, you simply need to enter the **Desired IP** for each port that needs to be configured.

STEP 3

Be sure to activate your settings before exiting.

- When using the Web Browser interface, activate by clicking on the Activate button.
- When using the Console utility, activate by first highlighting the **Activate** menu option, and then press **Enter**. You should receive the **Set device IP settings are now active! (Press any key to continue)** message.

Configuring Set Device IP



Desired IP Address

Setting	Description	Factory Default
IP Address	Sets the desired IP of connected devices.	None

Configuring DHCP Relay Agent

The DHCP Relay Agent makes it possible for DHCP broadcast messages to be sent over routers. The DHCP Relay Agent enables DHCP clients to obtain IP addresses from a DHCP server on a remote subnet, or those that are not located on the local subnet.

DHCP option 82

Option 82 is used by the relay agent to insert additional information into the client's DHCP request. The Relay Agent Information option is inserted by the DHCP relay agent when forwarding client-originated DHCP packets to a DHCP server. Servers recognize the Relay Agent Information option and use the Information to implement IP address assignment policies to the Client.

When Option 82 is enabled on the switch, a subscriber device or host is identified by the switch port through which it connects to the network (in addition to its MAC address). Multiple hosts on the subscriber LAN can be connected to the same port on the access switch and are uniquely identified.

The Option 82 information contains 2 sub-options: Circuit ID and Remote ID, which define the relationship between End Device IP and the DHCP option 82 server. The "Circuit ID" is a 4-byte number generated by combining the Ethernet switch's physical port number and VLAN ID. The format of the "Circuit ID" is described below:

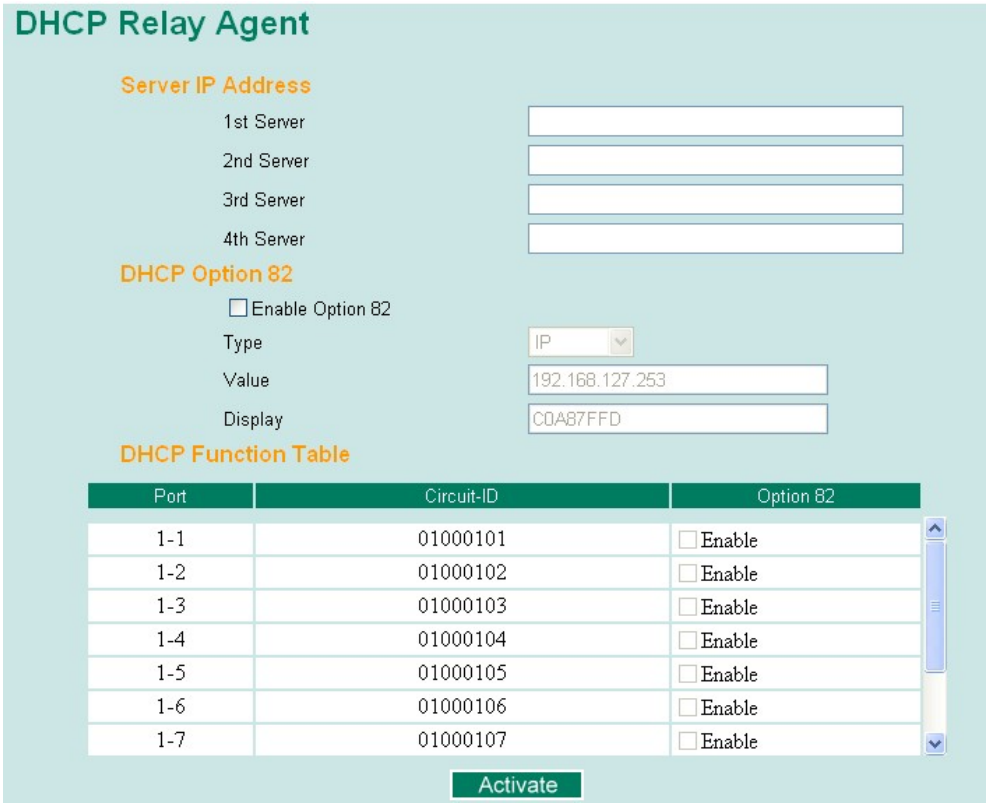
FF–VV–VV–PP

Where the first byte "FF" is fixed to "01", the second and the third byte "VV-VV" is formed by the port VLAN ID in hex, and the last byte "PP" is formed by the port number in hex. For example,

01–00–0F–03 is the "Circuit ID" of port number 3 with port VLAN ID 15.

The "Remote ID" is to identify the relay agent itself. It can be one of the following types:

1. The IP address of the relay agent.
2. The MAC address of the relay agent.
3. The combination of IP address and MAC address of the relay agent.
4. A user-defined string.



Server IP Address

1st Server

Setting	Description	Factory Default
IP address for the 1st DHCP server	The IP address of the 1st DHCP server that the switch tries to access.	None

2nd Server

Setting	Description	Factory Default
IP address for the 2nd DHCP server	The IP address of the 2nd DHCP server that the switch tries to access.	None

3rd Server

Setting	Description	Factory Default
IP address for the 3rd DHCP server	The IP address of the 3rd DHCP server that the switch tries to access.	None

4th Server

Setting	Description	Factory Default
IP address for the 4th DHCP server	The IP address of the 4th DHCP server that the switch tries to access.	None

DHCP Option 82

Enable Option82

Setting	Description	Factory Default
Enable or Disable	Enable or disable DHCP Option 82 function.	Disable

Type

Setting	Description	Factory Default
IP	Uses the switch's IP address as the remote ID sub-option.	IP

MAC	Uses the switch's MAC address as the remote ID sub-option.	IP
Client-ID	Uses the combination of the switch's MCA address and IP address as the remote ID sub-option.	IP
Other	Uses a user-defined value as the remote ID sub-option.	IP

Value

Setting	Description	Factory Default
	Displays the value according to the type you set.	
Max. 12 characters	If you set Other as Type, you will need to input the value.	switch IP address

Display

Setting	Description	Factory Default
	This hexadecimal value is automatically generated according to the Value field. It is the actual value set at the DHCP server as the Remote-ID to identify the relay agent. Users can not modify it.	COA87FFD

DHCP Function Table

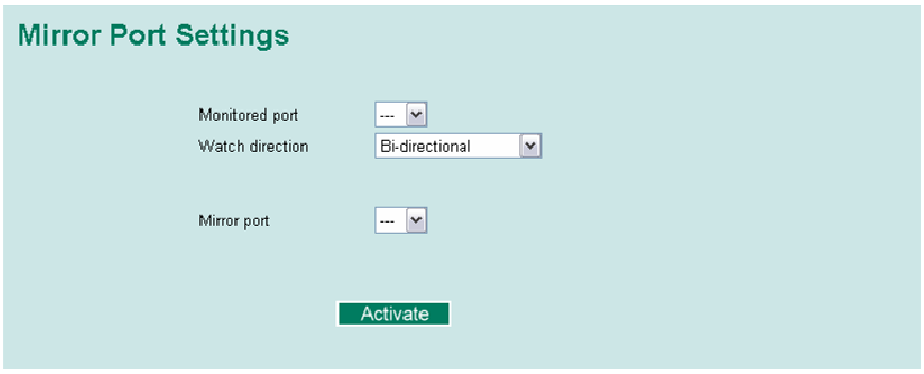
Enable

Setting	Description	Factory Default
Enable or Disable	Enable or disable DHCP Option 82 function for this port.	Disable

Using Diagnosis

The PT-7710 provides two important tools for administrators to diagnose network systems.

Mirror Port



The **Mirror port** function can be used to monitor data being transmitted through a specific port. This is done by setting up another port (the *mirror port*) to receive the same data being transmitted from, or both to and from, the port under observation. This allows the network administrator to **sniff** the observed port and thus keep tabs on network activity.

Take the following steps to set up the **Mirror Port** function:

STEP 1

Configure PT-7710's **Mirror Port** function from either the Console utility or Web Browser interface. You will need to configure three settings:

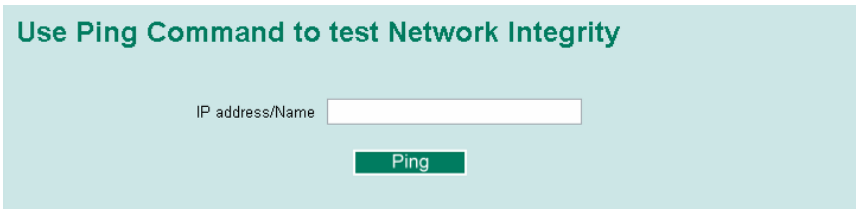
Monitored Port	Select the port number of the port whose network activity will be monitored.
Mirror Port	Select the port number of the port that will be used to monitor the activity of the monitored port.

Watch Direction	Select one of the following two watch direction options: • **Input data stream** Select this option to monitor only those data packets coming into the PT-7710's port. • **Output data stream** Select this option to monitor only those data packets being sent out through PT-7710's port. • **Bi-directional** Select this option to monitor data packets both coming into, and being sent out through, PT-7710's port.

STEP 2

- Be sure to activate your settings before exiting.
- When using the Web Browser interface, activate by clicking on the **Activate** button.
- When using the Console utility, activate by first highlighting the Activate menu option, and then press **Enter**. You should receive the **Mirror port settings are now active! (Press any key to continue)** message.

Ping

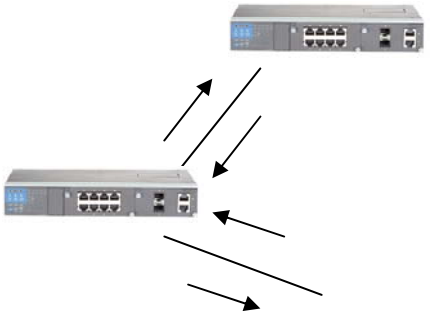


The **Ping** function uses the *ping* command to give users a simple but powerful tool for troubleshooting network problems. The function's most unique feature is that even though the ping command is entered from the user's PC keyboard, the actual ping command originates from PT-7710 itself. In this way, the user can essentially sit on top of PT-7710 and send ping commands out through its ports.

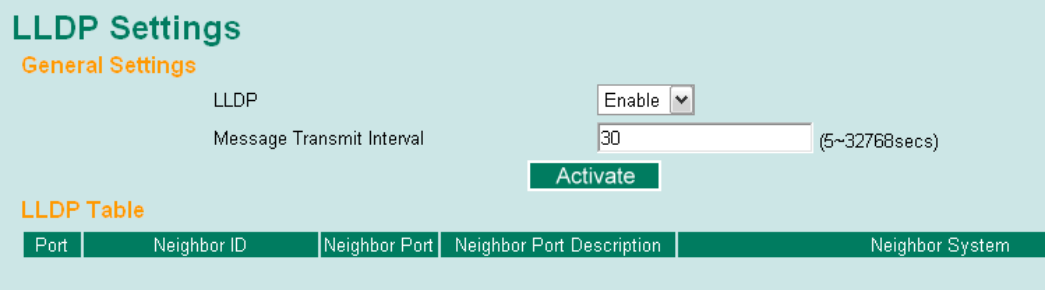
To use the Ping function, type in the desired IP address, and then press **Enter** from the Console utility, or click **Ping** when using the Web Browser interface.

LLDP

Defined by IEEE 802.11AB, LLDP is an OSI Layer 2 Protocol that standardizes the methodology of self-identity advertisement. It allows each networking device, e.g. a Moxa managed switch, to periodically inform its neighbors about its self-information and configurations. As a result, all of such devices would have knowledge about their neighbors; and through SNMP, this knowledge can be transferred to Moxa's MXview for auto-topology and network visualization purposes.



LLDP Settings



Enable LLDP

Setting	Description	Factory Default
Enable or Disable	Enable or disable LLDP function.	Enable

Value

Setting	Description	Factory Default
5 to 32758	Transmit interval of LLDP messages, in seconds.	30 (seconds)

LLDP

Setting	Description	Factory Default
Enable/Disable	Enable or disable LLDP function	Enable

Message Transmit Interval

Setting	Description	Factory Default
5 to 32768	Transmit interval of LLDP messages, in seconds.	30 (seconds)

LLDP Table

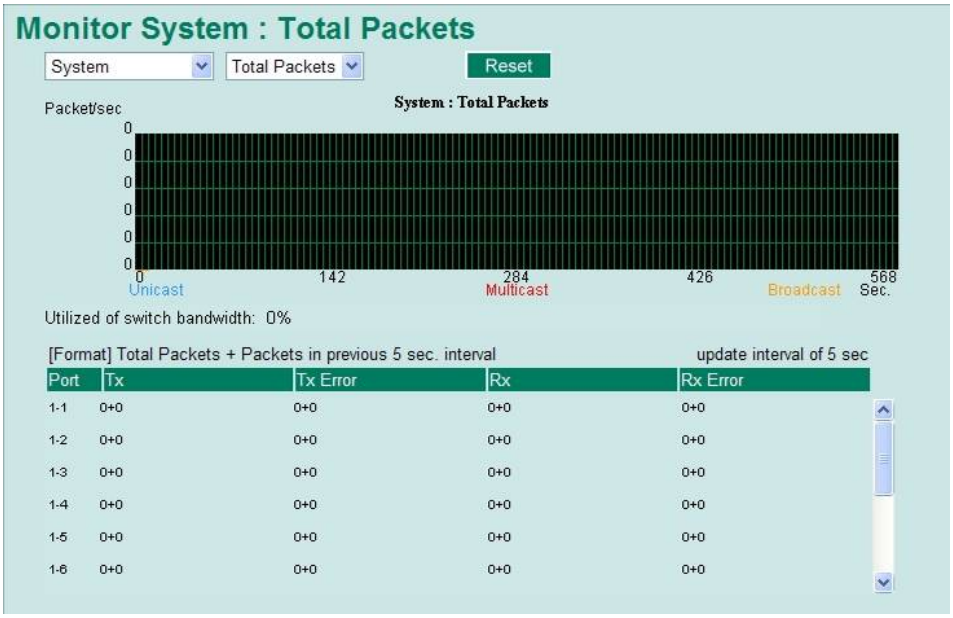
Setting	Description
Port	Port number of the port connecting to the neighboring device.
Neighbor ID	Entity that identifies a neighboring device uniquely (usually the MAC address)
Neighbor Port	The port number of connected neighboring device.
Neighbor Port Description	A textual description of the neighboring device's interface.
Neighbor System	Hostname of the neighboring device.

Using the Monitor

You can monitor statistics in real time from PT-7710's web console and serial console.

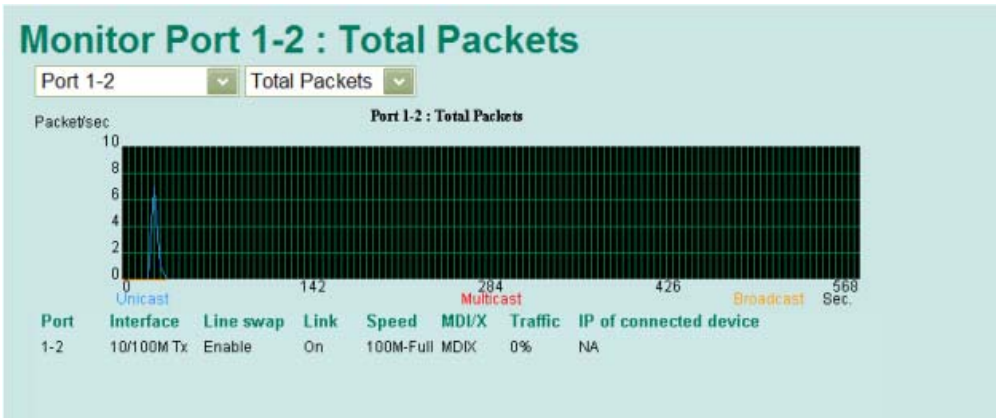
Monitor by Switch

Access the Monitor by selecting **System** from the left selection bar. Monitor by System allows the user to view a graph that shows the combined data transmission activity of all of PT-7710's 10 ports. Click one of the four options—**Total Packets**, **TX Packets**, **RX Packets**, or **Error Packets**—to view transmission activity of specific types of packets. Recall that TX Packets are packets sent out from PT-7710, RX Packets are packets received from connected devices, and Error Packets are packets that did not pass TCP/IP's error checking algorithm. The Total Packets option displays a graph that combines TX, RX, and TX Error, RX Error Packets activity. The graph displays data transmission activity by showing **Packets/s** (i.e., packets per second, or pps) versus **sec.** (seconds). In fact, three curves are displayed on the same graph: **Uni-cast** packets (in red color), **Multi-cast** packets (in green color), and **Broad-cast** packets (in blue color). The graph is updated every few seconds, allowing the user to analyze data transmission activity in real-time.



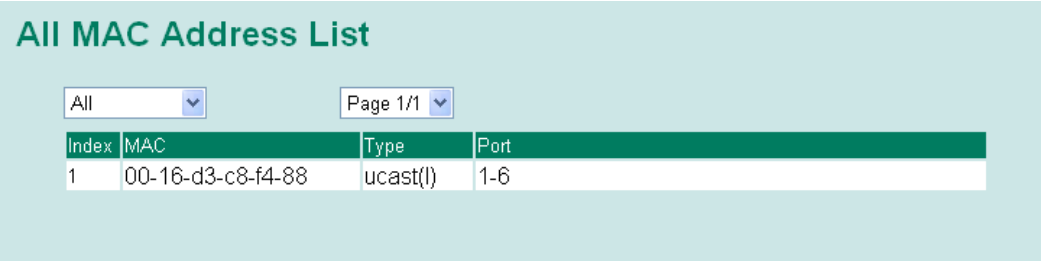
Monitor by Port

Access the Monitor by Port function by selecting **ALL 10/100M or 1G Ports** or **Port *i***, in which ***i*= 1-1, 1-2, …, 2-2**, from the left pull-down list. The **Port *i*** options are identical to the Monitor by System function discussed above, in that users can view graphs that show All Packets, TX Packets, RX Packets, or Error Packets activity, but in this case, only for an individual port. The **All Ports** option is essentially a graphical display of the individual port activity that can be viewed with the Console Monitor function discussed above. The All Ports option shows three vertical bars for each port. The height of the bar represents **Packets/s** for the type of packet, at the instant the bar is being viewed. That is, as time progresses, the height of the bar moves up or down so that the user can view the change in the rate of packet transmission. The blue colored bar shows **Uni-cast** packets, the red colored bar shows **Multi-cast** packets, and the orange colored bar shows **Broad-cast** packets. The graph is updated every few seconds, allowing the user to analyze data transmission activity in real-time.



Using the MAC Address Table

This section explains the information provided by PT-7710's MAC address table.



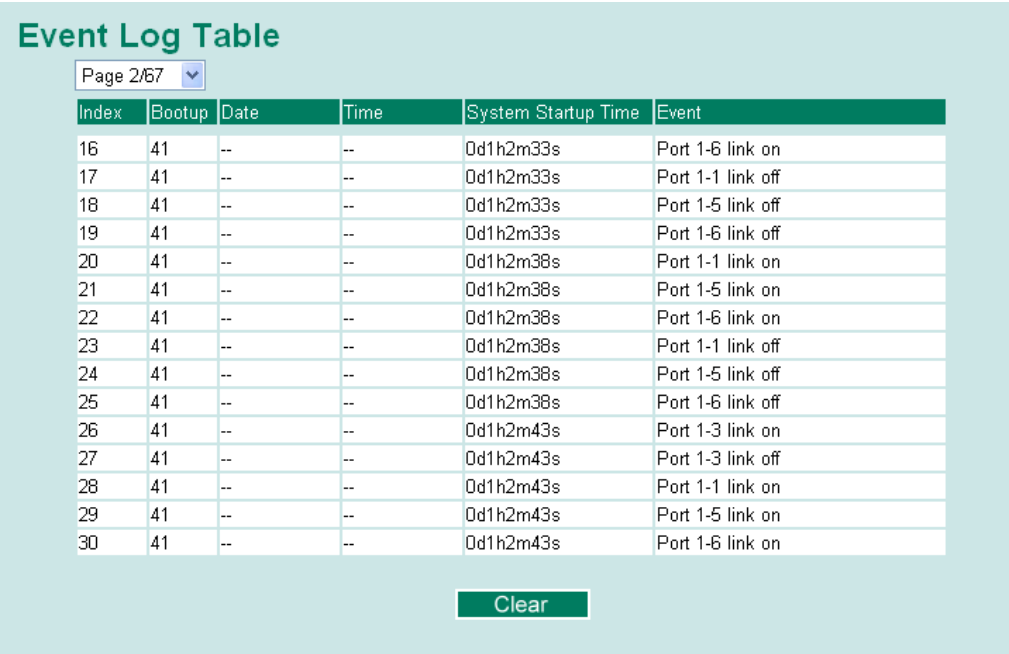
The MAC Address table can be configured to display the following PT-7710 MAC address groups.

ALL	Select this item to show all PT-7710 MAC addresses
ALL Learned	Select this item to show all PT-7710 Learned MAC addresses
ALL Static	Select this item to show all PT-7710 Static/Static Lock /Static Multicast MAC addresses
ALL Static Multicast	Select this item to show all PT-7710 Static Multicast MAC addresses
Port x	Select this item to show all MAC addresses of dedicated ports

The table will display the following information:

MAC	This field shows the MAC address
Type	This field shows the type of this MAC address
Port	This field shows the port that this MAC address belongs to

Using the Event Log


Event Log Table
Page 2/67
Index
Bootup
Date
Time
System Startup Time
Event
16 41 -- -- 0d1h2m33s Port 1-6 link on
17 41 -- -- 0d1h2m33s Port 1-1 link off
18 41 -- -- 0d1h2m33s Port 1-5 link off
19 41 -- -- 0d1h2m33s Port 1-6 link off
20 41 -- -- 0d1h2m38s Port 1-1 link on
21 41 -- -- 0d1h2m38s Port 1-5 link on
22 41 -- -- 0d1h2m38s Port 1-6 link on
23 41 -- -- 0d1h2m38s Port 1-1 link off
24 41 -- -- 0d1h2m38s Port 1-5 link off
25 41 -- -- 0d1h2m38s Port 1-6 link off
26 41 -- -- 0d1h2m43s Port 1-3 link on
27 41 -- -- 0d1h2m43s Port 1-3 link off
28 41 -- -- 0d1h2m43s Port 1-1 link on
29 41 -- -- 0d1h2m43s Port 1-5 link on
30 41 -- -- 0d1h2m43s Port 1-6 link on
Clear

Bootup	This field shows how many times the PT-7710 has been rebooted or cold started.
Date	The date is updated based on how the current date is set in the Basic Setting page.
Time	The time is updated based on how the current time is set in the Basic Setting page.
System Startup Time	The system startup time related to this event.
Events	Events that have occurred.

NOTE The following events will be record into PT-7710's Event Log Table.

- Cold start
- Warm start
- Configuration change activated
- Power 1/2 transition (Off (On), Power 1/2 transition (On (Off)
- Authentication fail
- Topology changed
- Master setting is mismatched
- Port traffic overload
- dot1x Auth Fail
- Port link off / on

Using Syslog

This function provides the event logs for the syslog server. The function supports 3 configurable syslog servers and syslog server UDP port numbers. When an event occurs, the event will be sent as a syslog UDP packet to the specified syslog servers.

Syslog Server 1

Setting	Description	Factory Default
IP Address	Enter the IP address of the 1st Syslog server used by your network.	None
Port Destination (1 to 65535)	Enter the UDP port of the 1st Syslog server.	514

Syslog Server 2

Setting	Description	Factory Default
IP Address	Enter the IP address of the 2nd Syslog server used by your network.	None
Port Destination (1 to 65535)	Enter the UDP port of the 2nd Syslog server.	514

Syslog Server 3

Setting	Description	Factory Default
IP Address	Enter the IP address of the 3rd Syslog server used by your network.	None
Port Destination (1 to 65535)	Enter the UDP port of the 3rd Syslog server.	514

NOTE

- The following events will be recorded into the PT-7710's Event Log table, and will then be sent to the specified Syslog Server:
- Cold start
- Warm start
- Configuration change activated
- Power 1/2 transition (Off (On), Power 1/2 transition (On (Off)
- Authentication fail
- Topology changed
- Master setting is mismatched
- Port traffic overload
- dot1x Auth Fail
- Port link off / on

A

MIB Groups

The PT-7710 comes with built-in SNMP (Simple Network Management Protocol) agent software that supports cold/warm start trap, line up/down trap, and RFC 1213 MIB-II.

The standard MIB groups that the PT-7710 supports are as follows:

MIB II.1—System Group

sysORTable

MIB II.2—Interfaces Group

ifTable

MIB II.4—IP Group

ipAddrTable
ipNetToMediaTable
IpGroup
IpBasicStatsGroup
IpStatsGroup

MIB II.5—ICMP Group

IcmpGroup
IcmpInputStatus
IcmpOutputStats

MIB II.6—TCP Group

tcpConnTable
TcpGroup
TcpStats

MIB II.7—UDP Group

udpTable
UdpStats

MIB II.10—Transmission Group

dot3
dot3StatsTable

MIB II.11—SNMP Group

SnmpBasicGroup
SnmpInputStats
SnmpOutputStats

MIB II.17—dot1dBridge Group

dot1dBase
    dot1dBasePortTable
dot1dStp
    dot1dStpPortTable
dot1dTp
    dot1dTpFdbTable
    dot1dTpPortTable

dot1dTpHCPortTable
dot1dTpPortOverflowTable
pBridgeMIB
dot1dExtBase
dot1dPriority
dot1dGarp
qBridgeMIB
dot1qBase
dot1qTp
dot1qFdbTable
dot1qTpPortTable
dot1qTpGroupTable
dot1qForwardUnregisteredTable
dot1qStatic
dot1qStaticUnicastTable
dot1qStaticMulticastTable
dot1qVlan
dot1qVlanCurrentTable
dot1qVlanStaticTable
dot1qPortVlanTable

The PT-7710 also provides a private MIB file, located in the file **Moxa-PT7710-MIB.my** on the PT-7710 utility CD-ROM.

Public Traps

- Cold Start
- Link Up
- Link Down
- Authentication Failure
- dot1dBridge New Root
- dot1dBridge Topology Changed

Private Traps

- Configuration Changed
- Power On
- Power Off
- Traffic Overloaded
- Turbo Ring Topology Changed
- Turbo Ring Coupling Port Changed
- Turbo Ring Master Mismatch

B

Modbus/TCP Map

Modbus Information

Read Only Registers (Support Function Code 4) ***1 word = 2 bytes***

Address	Data Type	Description
		System Information
0x0000	1 word	Vendor ID = 0x1393
0x0001	1 word	Unit ID (Ethernet = 1)
0x0002	1 word	Product Code = 0x0011
0x0010	20 word	Vendor Name = “Moxa” Word 0 Hi byte = ‘M’ Word 0 Lo byte = ‘o’ Word 1 Hi byte = ‘x’ Word 1 Lo byte = ‘a’ Word 2 Hi byte = ‘\0’ Word 2 Lo byte = ‘\0’
0x0030	20 word	Product Name = “PT-7710” Word 0 Hi byte = ‘P’ Word 0 Lo byte = ‘T’ Word 1 Hi byte = ‘-’ Word 1 Lo byte = ‘7’ Word 2 Hi byte = ‘7’ Word 2 Lo byte = ‘1’ Word 3 Hi byte = ‘0’
0x0050	1 word	Product Serial Number
0x0051	2 word	Firmware Version Word 0 Hi byte = major (A) Word 0 Lo byte = minor (B) Word 1 Hi byte = release (C) Word 1 Lo byte = build (D)
0x0053	2 word	Firmware Release Date Firmware was released on 2007-05-06 at 09 o’clock Word 0 = 0x0609 Word 1 = 0x0705
0x0055	3 word	Ethernet MAC Address Ex: MAC = 00-01-02-03-04-05 Word 0 Hi byte = 0x00 Word 0 Lo byte = 0x01 Word 1 Hi byte = 0x02 Word 1 Lo byte = 0x03 Word 2 Hi byte = 0x04 Word 2 Lo byte = 0x05

0x0058	1 word	Power 1 0x0000:Off 0x0001:On
0x0059	1 word	Power 2 0x0000:Off 0x0001:On
0x005A	1 word	Fault LED Status 0x0000:No 0x0001:Yes
0x0082	1 word	DO1 0x0000:Off 0x0001:On
Port Information		
0x1000 to 0x1009	1 word	Port 1 to 10 Status 0x0000:Link down 0x0001:Link up 0x0002:Disable 0xFFFF:No port
0x1100 to 0x1109	1 word	Port 1 to 10 Speed 0x0000:10M-Half 0x0001:10M-Full 0x0002:100M-Half 0x0003:100M-Full 0x0004:1G-Half 0x0005:1G- Full 0xFFFF:No port
0x1200 to 0x1209	1 word	Port 1 to 10 Flow Ctrl 0x0000:Off 0x0001:On 0xFFFF:No port
0x1300 to 0x1309	1 word	Port 1 to 10 MDI/MDIX 0x0000:MDI 0x0001:MDIX 0xFFFF:No port
0x1400 to 0x1409	20 word	Port 1 to 10 Description Port Description = “100TX,RJ45.” Word 0 Hi byte = ‘1’ Word 0 Lo byte = ‘0’ Word 1 Hi byte = ‘0’ Word 1 Lo byte = ‘T’ … Word 4 Hi byte = ‘4’ Word 4 Lo byte = ‘5’ Word 5 Hi byte = ‘.’ Word 5 Lo byte = ‘\0’
Packet Information		
0x2000 to 0x2013	2 word	Port 1 to 10 Tx Packets Ex: port 1 Tx Packets = 0x44332211 Word 0 = 4433 Word 1 = 2211

0x2100 to 0x2113	2 word	Port 1 to 10 Rx Packets Ex: port 1 Rx Packets = 0x44332211 Word 0 = 4433 Word 1 = 2211
0x2200 to 0x2213	2 word	Port 1 to 10 Tx Error Packets Ex: port 1 Tx Error Packets = 0x44332211 Word 0 = 4433 Word 1 = 2211
0x2300 to 0x2313	2 word	Port 1 to 10 Rx Error Packets Ex: port 1 Rx Error Packets = 0x44332211 Word 0 = 4433 Word 1 = 2211
Redundancy Information		
0x3000	1 word	Redundancy Protocol 0x0000:None 0x0001:RSTP 0x0002:Turbo Ring 0x0003:Turbo Ring V2
0x3100	1 word	RSTP Root 0x0000:Not Root 0x0001:Root 0xFFFF:RSTP Not Enable
0x3200 to 0x3209	1 word	RSTP Port 1 to 10 Status 0x0000:Port Disabled 0x0001:Not RSTP Port 0x0002:Link Down 0x0003:Blocked 0x0004:Learning 0x0005:Forwarding 0xFFFF:RSTP Not Enable
0x3300	1 word	TR Master/Slave 0x0000:Slave 0x0001:Master 0xFFFF:Turbo Ring Not Enable
0x3301	1 word	TR 1st Port status 0x0000:Port Disabled 0x0001:Not Redundant 0x0002:Link Down 0x0003:Blocked 0x0004:Learning 0x0005:Forwarding
0x3302	1 word	TR 2nd Port status 0x0000:Port Disabled 0x0001:Not Redundant 0x0002:Link Down 0x0003:Blocked 0x0004:Learning 0x0005:Forwarding
0x3303	1 word	TR Coupling 0x0000:Off 0x0001:On 0xFFFF:Turbo Ring Not Enable

0x3304	1 word	TR Coupling Port status 0x0000:Port Disabled 0x0001:Not Coupling Port 0x0002:Link Down 0x0003:Blocked 0x0005:Forwarding 0xFFFF:Turbo Ring Not Enable
0x3305	1 word	TR Coupling Control Port status 0x0000:Port Disabled 0x0001:Not Coupling Port 0x0002:Link Down 0x0003:Blocked 0x0005:Forwarding 0x0006:Inactive 0x0007:Active 0xFFFF:Turbo Ring Not Enable
0x3500	1 word	TR2 Coupling Mode 0x0000:None 0x0001:Dual Homing 0x0002:Coupling Backup 0x0003:Coupling Primary 0xFFFF:Turbo Ring V2 Not Enable
0x3501	1 word	TR2 Coupling Port Primary status (Using in Dual Homing, Coupling Backup, Coupling Primary) 0x0000:Port Disabled 0x0001:Not Coupling Port 0x0002:Link Down 0x0003:Blocked 0x0004:Learning 0x0005:Forwarding 0xFFFF:Turbo Ring V2 Not Enable
0x3502	1 word	TR2 Coupling Port Backup status (Only using in Dual Homing) 0x0000:Port Disabled 0x0001:Not Coupling Port 0x0002:Link Down 0x0003:Blocked 0x0004:Learning 0x0005:Forwarding 0xFFFF:Turbo Ring V2 Not Enable
0x3600	1 word	TR2 Ring 1 status 0x0000:Healthy 0x0001:Break 0xFFFF:Turbo Ring V2 Not Enable
0x3601	1 word	TR2 Ring 1 Master/Slave 0x0000:Slave 0x0001:Master 0xFFFF:Turbo Ring V2 Ring 1 Not Enable

0x3602	1 word	TR2 Ring 1 1st Port status 0x0000:Port Disabled 0x0001:Not Redundant 0x0002:Link Down 0x0003:Blocked 0x0004:Learning 0x0005:Forwarding 0xFFFF:Turbo Ring V2 Ring 1 Not Enable
0x3603	1 word	TR2 Ring 1 2nd Port status 0x0000:Port Disabled 0x0001:Not Redundant 0x0002:Link Down 0x0003:Blocked 0x0004:Learning 0x0005:Forwarding 0xFFFF:Turbo Ring V2 Ring 1 Not Enable
0x3680	1 word	TR2 Ring 2 status 0x0000:Healthy 0x0001:Break 0xFFFF:Turbo Ring V2 Ring 2 Not Enable
0x3681	1 word	TR2 Ring 2 Master/Slave 0x0000:Slave 0x0001:Master 0xFFFF:Turbo Ring V2 Ring 2 Not Enable
0x3682	1 word	TR2 Ring 2 1st Port status 0x0000:Port Disabled 0x0001:Not Redundant 0x0002:Link Down 0x0003:Blocked 0x0004:Learning 0x0005:Forwarding 0xFFFF:Turbo Ring V2 Ring 2 Not Enable
0x3683	1 word	TR2 Ring 2 2nd Port status 0x0000:Port Disabled 0x0001:Not Redundant 0x0002:Link Down 0x0003:Blocked 0x0004:Learning 0x0005:Forwarding 0xFFFF:Turbo Ring V2 Ring 2 Not Enable

C

Specifications

Technology

Standards:

IEEE 802.3 for 10BaseT

IEEE 802.3u for 100BaseT(X) and 100Base FX

IEEE 802.3ab for 1000BaseT(X)

IEEE 802.3z for 1000BaseX

IEEE 802.3x for Flow Control

IEEE 802.1D for Spanning Tree Protocol

IEEE 802.1w for Rapid STP

IEEE 802.1Q for VLAN Tagging

IEEE 802.1p for Class of Service

IEEE 802.1X for Authentication

IEEE 802.3ad for Port Trunk with LACP

Protocols: IGMPv1/v2 device, GMRP, GVRP, SNMPv1/v2c/v3, DHCP Server/Client, BootP, TFTP, SNTP, SMTP, RARP, RMON, HTTP, HTTPS, Telnet, SSH, Syslog, DHCP Option 66/67/82, LLDP, Modbus/TCP, IEEE 1588 PTP, IPv6, SNMP Inform

MIB: MIB-II, Ethernet-like MIB, P-BRIDGE MIB, Q-BRIDGE MIB, Bridge MIB, RSTP MIB, RMON MIB Group 1, 2, 3, 9

Flow Control: IEEE 802.3x flow control, back pressure flow control

Switch Properties

Priority Queues: 4

Max. Number of Available VLANs: 64

VLAN ID Range: VID 1 to 4094

IGMP Groups: 256

Interface

Fast Ethernet: Slot 1 for any combination of 4, 6, 7, or 8-port PM-7200 fast Ethernet modules with 10/100BaseT(X) (TP/M12 interface), 100BaseFX (SC/ST connector), or 100BaseSFP; Slot 2 for 1 or 2-port interface modules with 100BaseFX (SC/ST connector)

Gigabit Ethernet: Slot 2 for 2-port PM-7200 Gigabit Ethernet combo module, 100/1000BaseT(X) or 1000BaseSFP

Console Port: RS-232 (RJ45)

System LED Indicators: STAT, PWR1, PWR2, FAULT, MSTR/HEAD, CPLR/TAIL

Mode LED Indicators: LNK/ACT, FDX/HDX, RING PORT, COUPLER PORT, SPEED

Alarm Contact: 1 relay output with current carrying capacity of 3 A @ 30 VDC or 3 A @ 240 VAC

Power Requirements

Input Voltage:

• 12/24/48 VDC (9 to 60 V)

• 110/220 VDC/VAC (88 to 300 VDC and 85 to 264 VAC)

Input Current: (all ports are equipped with fiber)

• Max. 0.81 A @ 24 VDC

• Max. 0.42 A @ 48 VDC

• Max. 0.17/0.10 A @ 110/220 VDC

• Max. 0.20/0.12 A @ 110/220 VAC

Overload Current Protection: Present

Connection: 10-pin terminal blocks

Reverse Polarity Protection: Present

Physical Characteristics

Housing: IP30 protection

Dimensions: 266.5 x 44 x 195 mm (10.5 x 1.7 x 7.7 in)

Weight: 2200 g

Installation: 19'' rack mounting, wall mounting (with optional kit)

Environmental Limits

Operating Temperature: -40 to 85°C (-40 to 185°F); cold start requires min. of 100 VAC at -40°C

Storage Temperature: -40 to 85°C (-40 to 185°F)

Ambient Relative Humidity: 5 to 95% (non-condensing)

Regulatory Approvals

Safety: UL60950-1, CSA C22.2 No. 60950-1, EN60950-1

EMI: FCC Part 15, CISPR (EN55022) class A

Power Automation: IEC 61850-3, IEEE 1613

Traffic Control: NEMA TS2

Rail Traffic: EN50155, EN50121-4

Note: Please check Moxa's website for the most up-to-date certification status.

Warranty

Warranty Period: 5 years

Details: See www.moxa.com/warranty